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ABSTRACT

This study reports the results of the implementation of Project SEED, a mathematics program for urban elementary school students, in five urban districts: Camden (New Jersey); Dallas (Texas); Detroit (Michigan); Indianapolis (Indiana); and the West Contra Costa Unified School District in Richmond and San Pablo (California). Students exposed to at least 14 weeks of SEED instruction were compared with matched groups. Across the five districts, SEED students scored significantly better than non-SEED students on a test of algebraic concepts and in 21 of 23 statistical comparisons on 5 norm-referenced achievement analyses. Principals, teachers, students, and parents associated with the SEED program all responded positively to questionnaires about SEED. SEED instruction was generally seen to be very effective, accompanied by high rates of student participation and enthusiasm. Among the outcomes noted were increased student interest in mathematics, improved critical thinking and problem-solving skills, increased student motivation to learn, increased student self-confidence, and better understanding of mathematics. Results were very consistent across the five school districts. Six appendixes contain sample items from the algebra test results and results from the student, teacher, parent, and principal surveys. (Contains 15 tables and 11 references.) (Author/SLD)

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The National Evaluation of Project SEED In Five School Districts 1997-1998

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1997-98

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Executive Summary
National Evaluation of Project SEED
In Five School Districts
1997-98

Purpose

The purpose of this study is to evaluate the impact of Project SEED instruction on mathematics achievement and attitudes toward mathematics in five urban school districts. Students enrolled in SEED were at the third, fourth, fifth, and sixth grade levels with different grade configurations in the different districts. Sites include the Dallas Public Schools in Texas, the Detroit Public Schools in Michigan, the Indianapolis Public Schools in Indiana, the Camden City School District in New Jersey, and the West Contra Costa Unified School District in Richmond and San Pablo, California. Because each school district uses different testing programs and has different levels of data collection, the design was sufficiently diverse to allow for different inputs to the evaluation from different sites. In order to maintain promised anonymity among the five districts, data are coded and the districts in the study referred to as District 1, District 2, District 3, District 4, and District 5. Since local district cooperation is essential to the success of the program, attitudes of district teachers, administrators, parents, and students were also determined.

Student Mathematics Achievement

Sample. Each district in the study used a different configuration of norm-referenced tests. Table 1 shows the district number (1-5), the number of students in each sample, the standardized tests used, and the results for each of three mathematics subtests.

Results. Perusal of the data in Table 1 shows that the five districts employed five different norm-referenced achievement tests, with one district (District 5), using different pre- and posttests. In spite of the different measures of achievement, SEED students significantly outperformed non-SEED students in nine of ten *t-test* comparisons. When the analysis of covariance was applied to take into account the pre-treatment differences between groups that the sampling scheme for the *t-tests* didn't handle, the resulting F-statistics were generally much stronger and were statistically significant in twelve of thirteen comparisons. Thus, in spite of five different measures of achievement applied to students at different grade levels in five different school districts from different parts of the country, the results were very similar. SEED instruction contributed to increased scores on general measures of mathematics achievement. This occurred despite the fact that the SEED curriculum is not focused on increasing general mathematics scores on standardized tests.

Table 1
Summary of Mathematics Achievement Results
Five Districts, 1997-98

District	Tests Used (Criterion)	Total Math	Math Concepts	Math Computation
District 1 Grade 5 n=81	California Achievement Test	*t-test*, p≤.01 F-test, p<.0001	*t-test*, p≤.01 F-test, p<.0001	*t-test*, p≤.05 F-test, p≤.0009
District 2 Grade 4 n=322	Comprehensive Tests of Basic Skills	*t-test*, p≤.05 F-test, p<.0001	*t-test*, p≤.05 F-test, p≤.0014	*t-test*, p≤.05 F-test, p<.0001
District 3 Grade 3 n=302	Metropolitan Achievement Test	*t-test*, p≤.01 F-test, p<.0001	*t-test*, p≤.01 F-test, p<.0001	*t-test*, no difference F-test, p≤.0035
District 4 Grades 5 - 6 n=137	Iowa Tests of Basic Skills-Survey	*t-test*, p≤.05 F-test, p<.0088	No Data, Survey Test.	No Data, Survey Test.
District 5 Grades 4 - 6 n=323	Stanford 9 (ITBS pretest)	No *t-test* F-test, p≤.0039	No *t-test* F-test, p≤.0002	No *t-test* F-test, no difference

Student Algebra Achievement

Sample. 1440 students from four of the five study districts who had been exposed to SEED instruction during the first semester, were administered an evaluator-developed test of abstract algebra (group theory). A comparison group of 298 students were also administered this test. This test, titled Level A, is contained in Appendix A to this report. 515 students from three of the five studied districts, who had been exposed to SEED during the first or second semester, were administered an evaluator-developed test of exponentiation. A comparison group of 161 students were also administered this test. This test, titled Level B, is contained in Appendix B.

Results. The national sample of SEED students achieved a mean of 10.05 with a standard deviation of 4.69 on the test of abstract algebra (Level A). The comparison group achieved a mean of 4.52 with a standard deviation of 2.51. This produced a *t statistic* of 19.83 which is statistically significant at p<.001.

On the Level B test (exponents), Fall and Spring samples were combined for analysis. The SEED students achieved a mean of 11.24 with a standard deviation of 3.98 while the comparison group achieved a mean of 4.43 with a standard deviation of 1.94. This produced a *t statistic* of 20.20 which is statistically significant at p<.001.

Table 2 summarizes the algebra results for each district and for the aggregate.

Table 2
Summary of Algebra Results
Five Districts

District	Test	SEED N	SEED Mean	Comparison Mean	t-ratio	Probability
1 **Gr.4-5**	Group Theory	299	10.66	5.30	7.10	<.001
	Exponents	158	12.23	4.03	15.08	<.001
2 **Gr.4-5**	Group Theory	433	11.33	6.17	9.26	<.001
3 **Gr.3**	Group Theory	523	9.10	3.94	13.97	<.001
4 **Gr.5-6**	Exponents	193	11.70	4.30	14.08	<.001
5 **Gr.4-6**	Group Theory	175	8.62	4.30	7.03	<.001
	Exponents	164	9.76	3.95	12.21	<.001
Total **Gr. 3-6**	Group Theory	1440	10.05	4.52	19.83	<.001
	Exponents	515	11.24	4.43	20.20	<.001

Study of Table 2 suggests that the results of this series of analyses produced highly statistically significant differences between the SEED and comparison groups. These differences are of a magnitude to also be considered practically significant. Clearly SEED students are consistently learning algebraic concepts while comparison students are scoring around chance.

Student Opinions About SEED

Sample. 1837 students from the five urban school districts who had been exposed to SEED instruction were administered a seven item scale that was designed to determine their attitude toward SEED instruction as well as whether or not they perceived SEED instruction to have had an impact on their general mathematics ability and on their general feeling of confidence in school. (In the areas of student opinions, teacher opinions, principal opinions, and parent opinions, each district is discussed separately in the body of the report.)

Results. Results for the total sample across districts are tabled in Appendix C-6. A summary of those results suggests that, after exposure to Project SEED instruction, 97.2% of respondents enjoyed their SEED classes, 98.7% felt that they learned Algebra through their SEED classes, 90.9% felt that they liked mathematics more because of their experience with SEED, 93.1% believed that their mathematics abilities were stronger because of their exposure to SEED, 92.2% felt more confident about mathematics, and 89.2% felt more confident in school. Thus, study students expressed very positive attitudes about their experiences with SEED and believed that their positive SEED experience effected their overall attitude toward mathematics and school in general.

Classroom Teacher Opinions About SEED

Sample. 108 public school teachers from the five different urban school districts who had SEED specialists in their classrooms responded to an 18 item questionnaire about their experiences teaching mathematics and about Project SEED.

Results. Results for the aggregate of all districts are tabled in Appendix D-6. Significant facts include that only 10.2% of all respondents had either a college major or a minor in mathematics. Only two school districts reported having any teachers in the study that had majors or minors in mathematics. 71.3% had at least six years of teaching experience and 71% were experiencing their first year of SEED instruction.

In terms of observations about SEED, 72% of respondents believed that their experience with SEED significantly strengthened their understanding of mathematics while 99.1% felt that their understanding of mathematics was strengthened to some extent by exposure to SEED. 97.3% of respondents believed that the SEED instructional methods were notably effective and 98.2% believed that student enthusiasm and class participation was good to excellent. 91.6% of respondents observed normally shy or withdrawn students actively participating in the SEED classroom.

In response to a series of questions about the direct impact of SEED instruction on students, 87.9% of responding teachers believed that SEED considerably stimulated student interest in mathematics, 79.4% believed that student critical thinking and problem solving skills were extensively improved by SEED instruction, 85% believed that SEED instruction provided considerable motivation to learn, 88.8% held that student self-confidence was considerably improved, 74.1% saw significant improvement in peer relations, 65.7% observed substantial improvement in student communications skills, and 64.5% saw significant improvement in student performance in regular math classes. It should be noted that over 98% of responding teachers saw at least some improvement in all of these important student traits.

In terms of the impact of SEED on the actual teaching behavior of observing teachers, 96.3% reported gaining some new or insightful way to teach mathematical concepts and 99.1% employed one or more SEED instructional techniques in their teaching.

In summary, 100% of the teachers surveyed believed that Project SEED instruction was effective and 99.1% believed that it increased their own understanding of mathematics. Over 96% reported benefiting from new insights in how to teach mathematics and all but one teacher reported that they utilized at least one SEED instructional strategy in their own teaching.

SEED's direct impact on student instruction was seen as increasing student enthusiasm and class participation, stimulating student interest in mathematics, motivating students to learn, improving student academic self-confidence, improving student peer relations, improving student communication skills, and improving student performance in mathematics. Finally, 97.2% of responding teachers reported that they would like to see the type of instruction employed by Project SEED in more classrooms.

Principal Opinions About SEED

Sample. 69 principals from the five school districts responded to a 15 item questionnaire about their perceptions of Project SEED.

Results. Appendix E-6 contains the results of the Principal Survey tabulated across all districts in the study. 64.1% of reporting principals noted that they had had SEED classes in their building for more than one year. 95.6% reported observing a SEED class at least once during the year while 69.1% reported multiple observations.

95.7% of sampled principals rated the teaching methods employed by SEED as extremely effective while 83.8% felt that student enthusiasm and participation in SEED classes was excellent. In a series of parallel questions, 100% of responding principals reported that the SEED lessons considerably stimulated student interest in mathematics, 95.5 % believed that they greatly motivated students to learn, 88.3% held that they significantly helped improve critical thinking and problem solving skills, 92.8% recounted that they notably helped build student self-confidence, 82.1% saw significant impact on fostering better peer relationships, and 79.4% detected significant improvement in student communication skills. All principals believed that SEED had some impact on every one of these important student outcomes, except one principal saw little impact on communication skills.

In the area of professional relationships, principals consistently rated SEED specialists highly in a number of important areas and 98.5% believed that the SEED program positively affected the classroom teacher.

In summary, principals from five different school districts were very positive toward Project SEED and its specialists. They generally felt that SEED instruction was extremely effective, that it exerted a positive effect on the classroom teacher, that it motivated and stimulated students to learn mathematics, improved critical thinking and problem solving skills, and helped build student self-confidence and communications skills. Finally, 95.7% of involved principals would like SEED in their schools next year and 100% would like to see this kind of instruction in more classrooms.

Parent Opinions About SEED

Sample. 856 parents of students enrolled in SEED classes in five different school districts responded to a short questionnaire about Project SEED.

Results. Appendix F-6 contains the aggregate results of the Parent Survey across all five districts. 38.2% of parents reported observing a Project SEED class. 84.6% said that their children were very excited about studying Algebra through Project SEED, 87% reported that their children greatly enjoyed SEED classes, 70.7 % observed that their children's confidence had significantly improved since exposure to SEED, and 69.2% believed that their children's math ability had notably improved after exposure to SEED. Finally, 89.9% felt that other children should also be exposed to SEED.

Summary

Principals, classroom teachers, and parents of SEED students all believed that the SEED program provided significant value-added benefit to SEED students. In addition, principals and teachers believed that the classroom teacher benefited from witnessing SEED instruction, both from the standpoint of improved teaching methodology and strengthened understanding of mathematics.

SEED instruction was generally seen to be extremely effective accompanied by high rates of student participation and enthusiasm. Among the noted outcomes of SEED instruction were increased student interest in mathematics, improved critical thinking and problem solving skills, increased student motivation to learn, increased student self-confidence, and better understanding of mathematics. Student performance on five different nationally normed achievement tests as well as on the Algebra tests administered through this evaluation support these observations as well as point to increased student achievement levels in mathematics.

Students themselves reported enjoying their Project SEED Algebra classes, believed that they had learned Algebra through their SEED classes (an observation that is backed up by empirical data), liked mathematics more because of SEED, felt that their mathematical abilities were strengthened as a result of SEED, and reported notably increased feelings of confidence about mathematics and school in general.

This study was a cooperative study conducted across and within five school districts. These districts included Camden City School District in New Jersey, the Dallas Public Schools in Texas, the Detroit Public Schools in Michigan, the Indianapolis Public Schools in Indiana, and the West Contra Costa School District in Richmond and San Pablo, California. Results across these five districts were strikingly similar in terms of both cognitive impact of the program on student mastery of algebraic concepts and the strong support for the program from classroom teachers, principals, students, and parents. Perhaps the greatest measure of support for the program is that, across the five districts, 97.2% of classroom teachers and 100% of principals, polled by anonymous survey, said that they would like to see this type of instruction in more classrooms. In addition, 95.7% of principals reported that they would like SEED in their schools next year while 89.9% of the parents of SEED students believed that other children should be exposed to SEED. The amount of parental interest in the program is attested to by the fact that an unusually high 38.2% of parents across the five districts visited and observed a SEED class.

Successful programs in education are rare. Successful educational programs that have grassroots support are practically unique. From all of the data that have been analyzed across a number of different districts throughout a period of more than thirty years, SEED appears to be one of those unique programs. The findings of this study have supported the findings of previous studies. Project SEED has a positive impact on student achievement and attitudes toward school and mathematics as well as a positive impact on the instructional and mathematical abilities of observing teachers.

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This study reports the results of the implementation of Project SEED in five urban school districts (Camden, New Jersey; Dallas, Texas; Detroit, Michigan; Indianapolis, Indiana; and Richmond and San Pablo, California (West Contra Costa)). Students included in the treatment group (SEED) had to have been exposed to at least fourteen weeks of SEED instruction. A matched comparison group was utilized in each of the norm-referenced achievement analyses. Across the five districts, SEED students scored significantly better than non-SEED students on a test of algebraic concepts as well as on twenty-one of twenty-three statistical comparisons on five different norm-referenced achievement tests. Principals, teachers, students, and parents who were associated with the SEED program all responded extremely positively to a series of questionnaires about SEED. SEED instruction was generally seen to be extremely effective, accompanied by high rates of student participation and enthusiasm. Among the noted outcomes of SEED instruction were increased student interest in mathematics, improved critical thinking and problem solving skills, increased student motivation to learn, increased student self-confidence, and better understanding of mathematics. The aforementioned student performance on the Algebra test administered through this evaluation as well as increased scores on five different standardized achievement tests support these observations. Students themselves reported enjoying their Project SEED Algebra classes, believed that they had learned Algebra through their SEED classes (an observation that is validated by empirical data), liked mathematics more because of SEED, felt that their mathematical abilities were strengthened as a result of SEED, and reported notably increased feelings of confidence about mathematics and school in general. The results were very consistent across the five districts in the study.

Project SEED has undergone detailed evaluation in the Dallas and Detroit public schools as well as a number of other school districts. It is currently operating in a number of school districts across the country and SEED management as well as the former Dallas Superintendent requested a comprehensive evaluation of all of those sites. The purpose of this study is to evaluate the impact of Project SEED instruction on mathematics achievement and attitudes toward mathematics in five urban school districts. Students enrolled in SEED were at the third, fourth, fifth, and sixth grade levels with different grade configurations in the different districts. Sites include the Dallas Public Schools in Texas, the Detroit Public Schools in Michigan, the Indianapolis Public Schools in Indiana, the Camden City School District in New Jersey, and the West Contra Costa Unified School District in Richmond and San Pablo, California. Because different sites use different testing programs and have different levels of data collection, the design was sufficiently diverse to allow for different inputs to the evaluation from different sites. In order to maintain promised anonymity among the five districts, data are coded and the districts in the study referred to as District 1, District 2, District 3, District 4, and District 5.

Exemplary Instructional Strategies

There are a number of strategies that are recommended for classroom instruction that are endorsed by the National Council of Teachers of Mathematics (math standards), the National Research Council (science standards), the National Science Foundation, and Project SEED. The ideal scenario is described below.

The research base on teaching and learning provides insight into factors related to teachers and students that influence school learning. Included among influential factors are (a) curricular emphasis on both content and process knowledge; (b) active student engagement in learning; (c) accommodation of individual student differences; (d) emphasis on higher-order thinking strategies; (e) teachers as facilitators and mediators of learning; (f) a quality physical and learning environment; (g) efficient and effective time management; and (h) the observation and assessment of student outcomes.

Students are now viewed as active interpreters or mediators of teacher behaviors instead of passive recipients of those behaviors. Teachers are expected to provide relevant and meaningful learning experiences, to create a learner-centered community, to respond appropriately to diverse learners, and to create an environment in which taking risks, sharing new ideas, and innovative problem solving are supported and encouraged. Project SEED incorporates these strategies into its instructional delivery system.

Program Description

Project SEED is a national program in which professional mathematicians and scientists from major universities, research corporations, and the community teach abstract, conceptually oriented mathematics to full-sized classes of elementary school children on a daily basis as an extra-period supplement to their regular mathematics program. The mathematics is presented through the use of a Socratic group discovery format in which children discover mathematical concepts by answering a sequence of questions posed by the SEED instructor. Project SEED believes that only persons who understand mathematics in depth possess the versatility to capitalize on the unconventional and often original insights that children are capable of making in an open-ended mathematical dialogue. The initial mathematical topics are chosen from high school and college algebra to reinforce and improve the students' critical thinking and computational skills and to help equip them for success in college-preparatory mathematics courses at the secondary level. Subsequent material establishes the mathematical foundation for a number of advanced areas of study and progresses into advanced topics in abstract algebra and other areas. Project SEED teaches entire regular elementary school classes rather than specially selected groups of students. Although Project SEED is being implemented in a number of different districts and settings, this design assumes certain implementation characteristics regardless of implementation sites. Following is a description of a typical SEED class that evaluators will expect to see regardless of site.

A Typical SEED Class

Project SEED is a supplementary program that is taught by the SEED specialist assigned to a given class. The classroom teacher is present while SEED is being taught and participates in the instruction by using SEED discovery techniques. The students in the class receive regular baseline instruction in mathematics from their regular classroom teacher. (This will either be a mathematics teacher in a departmentalized setting or the classroom teacher in a self-contained setting.) The students then receive a period of SEED instruction four days a week from the SEED specialist. The fifth period is an inservice period for the SEED specialist. In this fifth period, the students work at the direction of the classroom teacher. This work may or may not be related to the material taught in Project SEED at the discretion of the teacher, but it usually is not.

Instruction in the SEED program will be considered in two parts, the instructional methodology of SEED and the mathematics content of the program. SEED uses a group instructional methodology. The class is taught using a series of directed questions. The instructor asks questions of individuals in the class or of the class as a whole. New material is introduced gradually and the majority of classroom time is usually spent in working on applications related to material previously encountered or in reviewing new and previous work. This emphasis upon application and review is intended to ensure that the students have a solid foundation in previously learned material before new material is introduced.

The SEED specialist uses a number of devices to manage the instruction in the classroom. The students are expected to respond to most of the questions and discussions in the class. The responses are given using hand signals unless the students are asked directly to respond verbally. Signals are used to indicate agreement and disagreement with the topics of discussion and to respond to questions. The purpose of the signals is to give the instructor continual feedback about student perceptions of the material, to ensure the involvement of most students in the dialogue on the material, and to maintain a degree of order in the classroom which could not be achieved using verbal responses. On the basis of the observations of SEED classes during the process evaluation in other settings, the signals seem to succeed in accomplishing these purposes.

To help ensure student involvement, each student is called upon several times each period to provide answers or comments. In the event a student is not participating in the discussions, the SEED instructor will use such devices as having the student call upon another student to provide an answer or calling upon the student to provide a number for a problem. Other devices used to keep student involvement at a high rate include having all students participate in group verbal responses to questions, having students write answers to questions on their papers and checking all or part of the papers immediately, or having all students show the answer to a question on their fingers. These methods and a number of others are all designed to keep student interest and involvement high, as well as to accomplish other instructional objectives.

To mitigate problems associated with locus of control in the classroom, the SEED specialist moves frequently in the classroom and avoids teaching and questioning from the same spot. This also helps keep students attentive since, at any moment, the instructor may be asking the next question from any part of the room. SEED classes have a higher proportion of visitors than usual, and the visitors and the teacher are utilized by the instructor. For example, the instructor might ask a visitor to call upon a student with his or her hand up to answer a question. In this fashion, the students become accustomed to visitors and enjoy sharing their knowledge with the visitors which enhances the whole experience.

The primary feature of the instructional system, however, is the set of questions asked by the SEED specialist. Almost all of the instruction is done through the use of questions. Rarely does the instructor directly tell the students anything. This is done, again, to help keep the student actively involved in the progress of the class and to avoid having the student as a passive recipient of the subject material. The instructor, in preparing for the class, thinks through the subject matter to be presented and assembles a list of sequenced questions which will be used as the basis of the questions asked of the students in class. These questions develop the content to be covered in a logical and detailed sequence which is then transferred to the classroom and form the heart of the SEED instructional process.

SEED Mathematics Content

The mathematics content in the SEED classes consists primarily of a thorough preparation in pre-algebra mathematics and beginning concepts of abstract algebra, with examples taken from the real number system. Some of the topics include properties of positive and negative numbers, the definition and properties of exponents, definition and properties of logarithms, use of the distributive law to prove properties of positive and negative numbers, the definition and properties of additive and multiplicative identities, the definition of additive and multiplicative inverses, the definition and properties of negative exponents, the definition and application of summation and product symbols, and an introduction to mathematical series.

Previous Studies

Dwight Shafer summarized a series of studies conducted on SEED between 1968 and 1975 (Shafer, 1975). These studies were conducted by a number of different investigators across four different states and included results from the Berkeley, California; Detroit, Michigan; San Jose, California; Columbus, Ohio; Oakland, California; Sacramento, California; Los Angeles, California; and Red Bank, New Jersey school districts. These studies included results on a number of different achievement tests as well as teacher, administrator, parent and student questionnaires. The evaluations ranged from the informal collection of achievement scores by SEED and district staff to large-scale statistical analyses by external evaluators. After reviewing these studies, Shafer concluded that *the overall record of Project SEED is outstanding in the area of student achievement as measured by normed instruments as well as non-normed instruments.* Shafer also emphasized that the achievement results were particularly impressive in that the project did not teach what was being tested in mathematics but rather emphasized abstract, conceptually oriented mathematics. The principal, teacher, parent, and student questionnaires also consistently yielded positive results.

Educational Planners and Evaluators conducted a series of studies on the impact of SEED instruction at grades 4 through 6 between 1975 and 1980 (Whalen, 1980). These studies involved seventeen school districts across ten states. Among their findings were that SEED students significantly outperformed control classes in a remarkably uniform manner, consistently showed an average mean gain of around two months' growth for each month of instruction, and worked across the entire spectrum of student achievement levels. They concluded that *Project SEED unquestionably fosters improved arithmetic skills in the vast majority of participating students* and that the summarized evaluations *provide overwhelming evidence of the ability of SEED to stimulate mathematical thinking in young children which enhances both their conceptual and computational skills.* After five years of studying the program, the evaluators called the SEED evaluation *the best results we have ever seen by any program.*

Seven more recent series of studies on the impact of SEED on student achievement and associated variables were conducted in the Dallas and Detroit Public Schools between 1982-83 and 1990-91. All studies focused on the immediate and longitudinal impact of SEED instruction on achievement in and attitudes about mathematics. All studies were conducted on students in grades 4 through 6. All studies used theoretical comparison groups. That is, each student in each of the SEED groups was systematically matched to a non-SEED comparison student. Comparison students were drawn from many District schools and thus represent many different math treatments. All matching was done in the year prior to exposure to SEED. Variables used in the matching process were gender, ethnicity, grade, socioeconomic status as indicated by free or reduced lunch, busing status, and mathematics achievement levels.

Series 1. The first study of SEED in the Dallas Public Schools was conducted in 1982-83 and examined the impact of one semester of SEED instruction on mathematics achievement and attitudes at the fourth or fifth grade level. Project SEED was implemented in eleven schools. According to the evaluation report (Mendro, 1983), the program was well managed and produced significant impact on student self-concept and achievement in mathematics.

Series 2. A second series of studies conducted in Dallas examined the impact of one semester of SEED instruction on mathematics achievement and attitude. Six different SEED groups drawn from the schools studied under Series 1 and their respective theoretical comparison groups were compared relative to post-SEED achievement trends in mathematics and enrollment in higher level mathematics courses. The design was set up so that each study was replicated within the design. Analyses were performed on two separate and distinct groups of fourth, fifth, and sixth graders, each being followed for a period of five years. Further replication studies were accomplished by examining the immediate impact of SEED instruction on student achievement in the year that SEED was offered, thus examining the impact of SEED on a group of students that did not exhibit the sample mortality of the five-year longitudinal groups.

In the case of this series of studies, SEED students were exposed to regular math plus SEED instruction, while comparison students were exposed only to regular math. Thus, part of the treatment was additional exposure to mathematics (45 minutes). Longitudinal group sizes ranged from 32 to 87. Short-term group sizes ranged from 245 to 295. Initial groups were chosen in 1982-83 and 1983-84.

The results of this second series of studies suggested strong and consistent immediate impact of SEED instruction on mathematics achievement as measured by the *Concepts, Problem Solving, Computation*, and *Math Total* sections of the *Iowa Tests of Basic Skills (ITBS).* These improved scores were generally present at least one year after students had been exposed to SEED. The results also suggested greater impact of SEED on the achievement of lower socioeconomic students. In addition, former SEED students clearly took higher percentages of advanced courses than did their matched comparisons (Webster and Chadbourn, 1988).

Series 3. The third series of studies conducted in Dallas examined the achievement trends of students who were enrolled in SEED three semesters: one in the fourth grade in 1984-85, one in the fifth grade in 1985-86, and one in the sixth grade in 1986-87. Project SEED had been implemented in three special schools, called Learning Centers, since the 1984-85 school year. Although the schools had many special programs and arrangements, they were primarily designed to raise student achievement levels in reading. Classes were self-contained and the homeroom teacher generally taught all subject areas except music and art. Instructional treatment in mathematics represented an extra 45-minutes of SEED instruction per day for four days a week. Comparison students had mathematics instruction by either self-contained teachers or departmentalized mathematics teachers for 60-minutes per day. SEED students had instruction by self-contained teachers (non-mathematics specialists) plus the instruction by SEED specialists. These were the best comparisons that were available, since all students in the special schools had SEED.

As in the series of studies outlined as Series 2 of this investigation, comparison groups were selected from groups of students similar to those who received SEED instruction. The same selection criteria were used as were used in Series 2 of the investigation except, of course, the comparison groups matched the characteristics of the Series 3 SEED students.

Two major questions were examined. First, were the post-SEED instructional achievement trends of SEED students different from those of comparison students who were not exposed to SEED? This question was examined separately using the *Math Concepts, Math Problem Solving, Math Computation*, and *Math Total* scores on the *ITBS*.

Second, given that the schools studied were Learning Centers and had many special arrangements over other schools, the same type of longitudinal analysis was done on reading. The case for a treatment effect of Project SEED would be greatly enhanced if math trends among Center students were more positive than reading trends. The reading subtest of the *ITBS* was used for this analysis. In addition, SEED databases were established so that SEED student achievement as well as mathematics course selection versus that of comparison students could be analyzed over succeeding years.

The cohort samples for this series of studies required four years of test data. There were 517 SEED and 517 comparison students. The samples were one hundred percent Black and Hispanic, and seventy-nine percent on free and reduced lunch. Their pre-1984 achievement levels ranged from the first to the tenth decile.

The results of this series suggested an immediate impact of SEED at the fourth grade level on mathematics achievement. This impact increased at grade 5 and further accelerated at grade 6. Thus, students who entered the fourth grade about even with their peers left the sixth grade about one-half year ahead of their peers in *Problem Solving* and almost one year ahead in *Concepts*. In addition, they were at or above grade level in *Concepts*, *Computation*, and *Total Math* scores.

Both the SEED and comparison samples had spring, 1984, mean scores of 3.33 in Reading. During the succeeding three years of instruction, the SEED sample advanced to a mean score of 5.98 while the comparison sample advanced to a mean score of 5.55. Thus, the SEED sample gained 2.65 grade equivalent units in reading while the comparison sample gained 2.22 grade equivalents in reading. Compare this to a mean gain of 3.18 grade equivalent units in mathematics for the SEED students versus 2.36 grade equivalents for the comparison group (Webster and Chadbourn, 1988).

Series 4. The fourth series of studies conducted in Dallas replicated the Series 2 studies plus added an additional outcome variable, a criterion-referenced test entitled the *Survey Tests of Essential Elements/Learner Standards (STEELS)*. This series of studies also examined retention rates, enrollment in higher-level mathematics classes, withdrawal rates, and long-term impact of SEED. Four different samples were used. These samples included: students who had SEED instruction in the Learning Centers in grades 4-6 in 1985 through 1988; students who had SEED instruction in the Learning Centers in grades 4-6 in 1986 through 1989; follow-up of students who had one semester of SEED in 1982-83 or 1983-84 as well as Learning Center students who had three semesters of SEED in 1984-87.

This series of studies on SEED took an in-depth look at the impact of SEED instruction on mathematics achievement as measured by the *ITBS* and *STEELS* and on student attitudes toward mathematics as measured by the enrollment of students in advanced math courses. Most of the students in the SEED group were also Learning Center students, thus introducing an intervening variable into the process of interpreting the results. Analyses of Learning Center Reading achievement were conducted to provide some measure of the impact of the Centers independent of SEED. Early non-Center SEED groups were also studied for this purpose.

Although the primary focus of this series of investigations was to examine the impact of Project SEED in the Learning Center environment, part of the study focused on non-Learning Center students who had only one semester of SEED in the fourth, fifth, or sixth grade. Although the achievement impact of this strategy appeared to wash out after two years, former SEED students still appeared to enroll in more higher level math classes, withdraw from the District less, and be retained fewer times than did their matched comparison groups.

The results of this series of studies suggested that SEED instruction in the Learning Centers contributed substantially to increased mathematics achievement as measured by the *ITBS* and *STEELS*, increased enrollment in higher level mathematics courses, lowered grade retention and District withdrawal rates, a cumulative impact on mathematics achievement, that is, longer exposure to SEED (up to three semesters) appeared to accelerate measured mathematics achievement growth, and, retention of mathematics gains for at least two years after exposure to just one semester of SEED (Webster and Chadbourn, 1989).

Series 5. The fifth series of studies conducted in Dallas replicated the Series 4 studies and followed up students who had been included in the Series 1 and Series 2 studies to determine longitudinal impact on mathematics achievement and enrollment in higher level mathematics courses. Eight different samples were used to implement three different studies.

The first was a study of students who were exposed to one, two, or three semesters of SEED instruction in the Centers culminating in the spring of 1990. These students were compared with their matched comparison groups on the *ITBS Math Total, Concepts, Problem Solving* and *Computation* subtests, as well as the *STEELS*

Mathematics test. All comparisons were significant, $p \leq .01$, in favor of the SEED groups.

The second study was a longitudinal follow-up of these students who had three semesters of SEED in the Centers in 1984-87, 1985-88, or 1986-89. These students were compared with their matched comparison groups on the *Math Total, Concepts, Problem Solving*, and *Computation* subtests of the *ITBS*. The results of this study replicated the finding of a cumulative impact on mathematics achievement of increasing semesters of SEED (up to three), of continued mathematics achievement impact up to two years after SEED instruction was completed, and of more SEED students enrolling in higher level mathematics courses.

The third study completed the follow-up of students who had had one semester of SEED in a non-Learning Center environment in 1982-83 or 1983-84. These students enrolled in more higher level mathematics courses than their matched comparisons (Webster and Chadbourn, 1990).

Series 6. The sixth series of studies conducted in Dallas replicated Series 5 studies and extended the follow-up of grade 4-6 Center students to the tenth grade. Once again, SEED students demonstrated increased mathematics achievement levels as well as improved mathematics achievement for the duration of the study which encompassed up to four years after exposure to SEED (Webster and Chadbourn, 1991).

Series 7. The seventh series of studies were conducted in the Detroit Public Schools from 1991 to 1993. In all comparisons, students who had been exposed to SEED for one semester outperformed matched comparison students on all mathematics subtests of the *California Achievement Test (CAT)*. In addition, students who were exposed to two semesters of SEED instruction outperformed students exposed to one semester of SEED instruction on all mathematics subtests of the *CAT*. Principals, classroom teachers, and parents of SEED students rated SEED teaching methods as extremely effective, student enthusiasm and participation in the program as excellent, and listed student benefits from the program as including improved critical thinking, listening, and problem-solving skills, increased motivation to learn, increased academic confidence and self-esteem, and increased performance in the regular mathematics program (Webster, 1993).

Summary. In summary, two national studies and seven series of studies in Dallas and Detroit at the grades 4-6 levels provide an in-depth look at the impact of SEED instruction on mathematics achievement as measured by a number of standardized achievement tests, and on student attitudes toward mathematics as measured by the enrollment of students in advanced math courses as well as by a series of surveys. The results are very consistent. The two national studies document increased mathematics achievement related to exposure to SEED as well as a number of other attitudinal effects. The studies conducted in Dallas and Detroit support the findings of the national studies.

Specifically, the results of the studies in the Learning Centers in Dallas suggested that SEED instruction in the Learning Centers contributed substantially to increased mathematics achievement as measured by the *ITBS* and *STEELS*, increased enrollment in higher level mathematics courses, a cumulative impact on mathematics achievement (longer exposure to SEED appeared to accelerate measured mathematics achievement growth), and retention of mathematics gains for at least four years after exposure to SEED.

Although the primary focus of the series of investigations in Dallas was to examine the impact of Project SEED in the Learning Center environment, several studies in Dallas and Detroit focused on non-Learning Center students who had only one semester of SEED in the fourth, fifth, or sixth grade. In both Dallas and Detroit there was significant impact on mathematics achievement after only one semester of SEED instruction that was still present after two years and, where studied, former SEED students enrolled in more higher level math classes than did their matched comparison groups. In addition, students exposed to two semesters of SEED in a non-Learning Center environment outperformed students exposed to one semester of SEED. In all cases surveys of parents, teachers, and administrators were very positive toward SEED.

The most recent studies on the impact of SEED have been conducted in the Alameda Unified School District (Alameda Unified School District and Project SEED, 1997), the Dallas Public Schools (Chadbourn, 1995; Dryden and Chadbourn, 1996), and The School District of Philadelphia (Latham, 1992). Results were strikingly similar to those reported above. The Alameda Unified School District study reported a 20% or greater gain for SEED students over matched comparisons on that system's standardized test. The Chadbourn study reported SEED students outperforming matched comparison students in 41 of 45 comparisons on a nationally standardized test of mathematics and that regular mathematics teachers of SEED classes believed strongly that SEED instruction encourages learning through discovery, emphasizes higher order thinking skills, and is effective for both high and low scoring students. The Latham study reported *unbelievably* high rates of student response opportunities and positive teacher-pupil interactions as well as *remarkably* high levels of student on-task behavior. Finally, the Dryden study concluded that the SEED group maintained above norm-level performance for the past ten years and drew the obvious conclusion that SEED students learn what they are taught. SEED focuses on conceptual mathematics and students learn conceptual mathematics.

Study Description

As previously stated, the purpose of this study is to evaluate the impact of Project SEED instruction on mathematics achievement and attitudes toward mathematics in five urban school districts. Students enrolled in SEED were at the third, fourth, fifth, and sixth grade levels with different grade configurations in the different districts.

The Theoretical Comparison Group

In the field of practical evaluation it is often impossible to implement true experimental designs. The concept of randomly assigning students to treatments is repugnant to most educators, particularly in situations where it is perceived that one group of randomly assigned students will be deliberately withheld from what is often believed to be an effective educational treatment. Thus the problem of identifying appropriate comparison groups is crucial to the interpretability of results. The literature is replete with warnings of the threats to the validity of experiments involved in comparing non-randomly assigned intact groups.

All of the initial comparisons in this series of studies utilize theoretical comparison groups. Each student in each of the experimental groups (SEED) was systematically matched to a comparison student. These comparison students were drawn from District schools that were also matched to SEED schools and thus represent many different math treatments. The one thing that the comparison students and schools that they were drawn from all have in common is that they have not been exposed to SEED. All matching was done in the year prior to exposure to SEED. Variables used in the matching process at the school level in most districts were:

1. Mean *Reading Comprehension* pretest score
2. Mean *Math Total* pretest score
3. Percentage of students on free or reduced lunch
4. Percentage of limited English proficient students
5. Ethnic percentages

It is important to note that the number of SEED and comparison schools do not have to be the same since the actual matching is done at the student level. Equal numbers of students did not have to be drawn from the same comparison schools as were drawn from SEED schools. For this reason, an attempt was made to make the composite of comparison schools as much like the composite of SEED schools as possible. Variables used to match SEED and comparison students in most districts were:

1. *Reading Comprehension* pretest score
2. *Math Total* pretest score
3. Socioeconomic status as indicated by free or reduced lunch
4. Ethnicity
5. Grade (previous and current year)

The original design had called for gender to be one of the classification and analysis variables. Since, upon examination, gender was consistently unrelated to mathematics performance, it was not used as a classification nor as a predictor in most of the equations. It is included in the District 3 mathematics analysis as a demonstration of its inability to predict mathematics achievement.

Limitations

SEED represents double mathematics exposure for those students who are enrolled. Over the years a series of studies have been designed to isolate the effects of double mathematics exposure by utilizing a comparison group for SEED that employs two periods of mathematics instruction. As of this date, we have not found a school that has been willing to implement two periods of mathematics instruction without SEED. Perhaps the fact that, in this era of accountability, no one is willing to implement two periods of mathematics instruction without SEED provides an answer to this query.

A second limitation is that, in several of the Districts included in this evaluation, SEED staff has provided training to a number of teachers outside of the classes actually receiving SEED instruction. This has probably aided these teachers in facilitating more effective mathematics instruction and reduced the apparent treatment effect of SEED.

Sample

For purposes of drawing treatment and comparison groups for the norm-referenced achievement analyses, two levels of sampling were used. The first involved matching at the school level. Each district had different numbers of SEED and comparison schools with different grade configurations in the sample. District 1 contributed twelve SEED classes at the fourth and fifth grade levels drawn from nine schools. Their comparison schools, except for one, were the same as their SEED schools because SEED was in all but one school in the district. District 2 contributed twenty-one classes at the fourth grade level drawn from fifteen schools as well as twenty comparison schools. District 3 contributed twenty-six SEED classes at the third grade level drawn from nineteen schools as well as fifteen comparison schools. District 4 contributed nine SEED classes and appropriate numbers of comparison students at the fifth and sixth grade levels drawn from seven schools as well as seven comparison schools. District 5 contributed fourteen classes at the fourth, fifth, and sixth grade levels drawn from seven schools as well as four comparison schools. Thus this study involved eighty-two SEED classes drawn from fifty-seven schools involving five districts as well as forty-seven comparison schools.

Once the schools were chosen, all SEED students with complete data were included in the various analyses. Comparison students were matched to SEED students on a student-by-student basis as outlined in the above section on the Theoretical Comparison Group.

Study Results

Program Implementation

Sample. The evaluator viewed SEED classroom instruction at three different sites across the country.

Results. The classroom observations of SEED instruction yielded consistent results that are in harmony with the SEED program description and with the national standards outlined in the first section of this report.

Student Algebraic Achievement

All *t-tests* referred to in this section and used to analyze Algebra Test data are non-directional tests for independent samples that assume equal variances, the most conservative parametric tests available. The evaluator-developed Algebra tests are contained in Appendices A (Group Theory) and B (Exponentiation) of this report. Both are 20 item tests.

Sample: District 1. 299 students, who had been exposed to SEED instruction at the fourth and fifth grade levels during the first semester of 1997, were administered an evaluator-developed test of abstract algebra (group theory). A comparison group of 43 students were also administered this test. This test, titled Level A, is contained in Appendix A to this report. 141 fourth and fifth grade students, who had been exposed to SEED during the first semester, and 17 students exposed during the second semester, were administered an evaluator-developed test of exponentiation. A comparison group of 68 students were also administered this test. This test, titled Level B, is contained in Appendix B.

Results: District 1. The District 1 SEED students achieved a mean of 10.66 with a standard deviation of 4.86 on the test of abstract algebra (Level A). The comparison group achieved a mean of 5.30 with a standard deviation of 2.27. This produced a *t-statistic* of 7.10 which is statistically significant at $p<.001$.

On the Level B test (exponents), fall and spring samples were combined for analysis. The SEED students achieved a mean of 12.23 with a standard deviation of 4.31 while the comparison group achieved a mean of 4.03 with a standard deviation of 2.27. This produced a *t-statistic* of 15.08 which is statistically significant at $p<.001$.

Sample: District 2. 433 fourth and fifth grade District 2 students, who had been exposed to SEED instruction during the first or second semester, were administered an evaluator-developed test of abstract algebra (group theory). A comparison group of 65 students was also administered this test. This test is contained in Appendix A of this report.

Results: District 2. District 2 SEED students achieved a mean of 11.33 with a standard deviation of 4.35 on the test of abstract algebra. The comparison group achieved a mean of 6.17 with a standard deviation of 2.27. This produced a *t-statistic* of 9.26 which is statistically significant at p<.001.

Sample: District 3. 523 students, who had been exposed to SEED instruction at the third grade level during the first semester of 1997, were administered an evaluator-developed test of abstract algebra (group theory). A comparison group of 133 students were also administered this test. This test is contained in Appendix A to this report.

Results: District 3. District 3 SEED students achieved a mean of 9.10 with a standard deviation of 4.13 on the test of abstract algebra. The comparison group achieved a mean of 3.94 with a standard deviation of 2.06. This produced a *t-statistic* of 13.97 which is statistically significant at p<.001.

Sample: District 4. 193 fifth and sixth grade District 4 students, who had been exposed to SEED instruction for at least fourteen weeks during the first semester, 1997, were administered an evaluator-developed test of algebraic exponentiation (Appendix B). No comparison group of District 4 students was tested but comparison groups of 68 students and 93 students from two other school districts were available.

Results: District 4. District 4 SEED students achieved a mean of 11.70 with a standard deviation of 4.31 on the test of algebraic exponentiation (Appendix B). The first comparison group achieved a mean of 4.30 with a standard deviation of 1.85 while the second comparison group achieved a mean of 3.95 with a standard deviation of 2.01. The SEED groups in these two districts achieved means of 12.23 and 9.76 with standard deviations of 4.31 and 4.33 respectively. All comparisons produced *t-statistics* that were statistically significant at p<.001.

Sample: District 5. 175 fourth, fifth, and sixth grade District 5 students, who had been exposed to SEED instruction during the first semester of 1997, were administered an evaluator-developed test of abstract algebra (group theory). A comparison group of 57 students were also administered this test. This test, titled Level A, is contained in Appendix A to this report. 142 students, who had been exposed to SEED during the first semester, and 22 students exposed during the second semester, were administered an evaluator-developed test of exponentiation. A comparison group of 93 students were also administered this test. This test, titled Level B, is contained in Appendix B.

Results: District 5. The District 5 SEED students achieved a mean of 8.62 with a standard deviation of 4.46 on the test of abstract algebra (Level A). The comparison group achieved a mean of 4.30 and with a standard deviation of 2.26. This produced a *t-statistic* of 7.03 which is statistically significant at p<.001.

On the Level B test (exponents), fall and spring samples were combined for analysis. The SEED students achieved a mean of 9.76 with a standard deviation of 4.33 while the comparison group achieved a mean of 3.95 with a standard deviation of 2.01. This produced a *t-statistic* of 12.21 which is also statistically significant at p<.001.

Sample: All Districts. 1440 students from four of the five study districts who had been exposed to SEED instruction during the first semester, were administered an evaluator-developed test of abstract algebra (group theory). A comparison group of 298 students were also administered this test. This test, titled Level A, is contained in Appendix A to this report. 515 students from three of the five studied districts, who had been exposed to SEED during the first or second semester, were administered an evaluator-developed test of exponentiation. A comparison group of 161 students were also administered this test. This test, titled Level B, is contained in Appendix B.

Results: All Districts The national sample of SEED students achieved a mean of 10.05 with a standard deviation of 4.69 on the test of abstract algebra (Level A). The comparison group achieved a mean of 4.52 with a standard deviation of 2.51. This produced a *t-statistic* of 19.83 which is statistically significant at $p<.001$.

On the Level B test (exponents), fall and spring samples were combined for analysis. The SEED students achieved a mean of 11.24 with a standard deviation of 3.98 while the comparison group achieved a mean of 4.43 with a standard deviation of 1.94. This produced a *t-statistic* of 20.20 which is statistically significant at $p<.001$. Table 1 summarizes the algebra results.

Table 1
Summary of Algebra Results
Five Districts

District	Test	SEED N	SEED Mean	Comparison Mean	t-ratio	Probability
1	Group Theory	299	10.66	5.30	7.10	<.001
Gr.4-5	Exponents	158	12.23	4.03	15.08	<.001
2 **Gr.4-5**	Group Theory	433	11.33	6.17	9.26	<.001
3 **Gr.3**	Group Theory	523	9.10	3.94	13.97	<.001
4 **Gr.5-6**	Exponents	193	11.70	4.30	14.08	<.001
5	Group Theory	175	8.62	4.30	7.03	<.001
Gr.4-6	Exponents	164	9.76	3.95	12.21	<.001
Total	Group Theory	1440	10.05	4.52	19.83	<.001
Gr. 3-6	Exponents	515	11.24	4.43	20.20	<.001

Study of Table 1 suggests that the results of this series of analyses produced highly statistically significant differences between the SEED and comparison groups. These differences are of a magnitude to also be considered practically significant. Clearly SEED students are consistently learning algebraic concepts while comparison students are scoring around chance.

Student Mathematics Achievement

Sample: District 1. 81 District 1 fifth grade students who had been exposed to at least fourteen weeks of SEED instruction and their 81 matched comparisons were tested with the *Math Computation*, *Math Concepts and Analysis*, and *Math Total* subtests of the *California Achievement Test*. (Fourth grade norm-referenced test scores were not provided by the District.) These students were tested in the spring of 1997 and again in the spring of 1998. The students were matched as described above. The closeness of the match can be seen by the fact that the pretest *Reading Comprehension* Normal Curve Equivalent (NCE) was 46.4 for both the comparison and experimental groups while the pretest *Math Total* NCE was 58.8 for the experimental and 60.1 for the comparison group. It is important to note that students were first matched on *Reading Comprehension* since there is no way to effectively statistically adjust for differences in pre-treatment reading levels.

Results: District 1. SEED students significantly outscored the comparison students on all three measures of mathematics achievement. They achieved a mean NCE of 53.1 with a standard deviation of 16.4 on *Math Total* as compared to a mean NCE of 44.3 with a standard deviation of 15.6 for the comparison group, a difference that produced a *t-statistic* of 3.49 and was statistically significant, $p \leq .01$. On *Math Computation*, the SEED group outscored the comparison group in mean NCE performance 54.8 (standard deviation of 17.9) to 47.3 (standard deviation of 16.9), a difference that produced a *t-statistic* of 2.73 and was statistically significant, $p \leq .05$. On *Math Concepts and Analysis*, the SEED group achieved a posttest mean of 50.7(standard deviation of 16.0) compared to a comparison group mean of 41.9 (standard deviation of 14.9). This difference was again statistically significant, $p \leq .01$, producing a *t-statistic* of 3.64. As in the case of the algebra analysis, the *t-tests* used were non-directional tests for independent samples that assume equal variances.

A simple analysis of covariance was also computed on the District 1 data. Predictors were 1997 Reading Comprehension, 1997 Mathematics (Total to predict Total, Computation to predict Computation, Analysis to predict Analysis), and enrollment in SEED. (No demographic variables were employed in the analysis because of the closeness of the match.) Table 2 presents the effects test from the analysis of covariance performed on the 1998 *Math Total* posttest.

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Table 2
Effects Test: District 1
Total Mathematics Posttest-1998

Source	df	ss	F ratio	Probability
SEED	1	3405.53	18.1496	<.0001
97 Reading Comp.	1	2508.66	13.3698	≤.0003
97 Math Total	1	3958.03	21.0942	<.0001

df=degrees of freedom
ss=sum of squares

Study of Table 2 suggests significant effects of pretest *Reading Comprehension* and *Math Total* scores on 1998 posttest *Math Total* scores as well as a significant effect of SEED participation on those same scores (p<.0001).

Table 3 presents the effects test from the analysis of covariance performed on the 1998 *Math Computation* posttest.

Table 3
Effects Test: District 1
Math Computation Posttest-1998

Source	df	ss	F ratio	Probability
SEED	1	2537.03	11.3985	≤0.0009
97 Reading Comp.	1	2977.74	13.3786	≤0.0003
97 Math Comp.	1	7546.66	33.9061	<0.0001

df=degrees of freedom
ss=sum of squares

Study of Table 3 suggests significant effects of pretest *Reading Comprehension* and *Math Computation* scores on 1998 posttest *Math Computation* scores as well as a significant effect of SEED participation on those same scores (p≤.0009).

Table 4 presents the effects test from the analysis of covariance performed on the 1998 *Math Analysis* posttest.

Table 4
Effects Test: District 1
Mathematics Analysis Posttest-1998

Source	df	ss	F ratio	Probability
SEED	1	3423.21	18.8906	<0.0001
97 Reading Comp.	1	2006.81	11.0744	≤0.0011
97 Math Analysis	1	2045.60	11.2884	≤0.0010

df=degrees of freedom
ss=sum of squares

Study of Table 4 suggests significant effects of pretest *Reading Comprehension* and *Math Analysis* scores on 1998 posttest *Math Analysis* scores as well as a significant effect of SEED participation on those same scores (p<.0001).

Taking all of the test data into account, it seems obvious that participation in SEED instruction contributed to substantially increased mathematics test scores among District 1 students.

Sample: District 2. 322 District 2 fourth grade students who had been exposed to at least fourteen weeks of SEED instruction and their 322 matched comparisons were tested with the *Math Computation*, *Math Concepts and Applications* and *Math Total* as well as the *Reading Total* subtests of the *Comprehensive Tests of Basic Skills (CTBS)*. These students were tested in the Spring of 1997 and again in the Spring of 1998. The 1997 test was the *CTBS-4* while the 1998 test was the *CTBS-5* or *Terra Nova*. The closeness of the match can be seen by the fact that the pretest *Reading Comprehension* mean *Normal Curve Equivalent (NCE)* was 54.70 for the comparison group and 54.46 for the SEED group while the pretest *Math Total* mean *NCE* was 59.99 for the comparison group and 58.54 for the SEED group.

Results: District 2. District 2 SEED students significantly outscored the comparison students on all three measures of mathematics achievement. They achieved a mean NCE of 54.67 with a standard deviation of 16.65 on *Math Total* as compared to a mean NCE of 51.43 with a standard deviation of 16.43 for the comparison group, a difference that produced a *t-statistic* of 2.48 and was statistically significant, p≤.05. On *Math Computation*, the SEED group outscored the comparison group in mean NCE performance 49.38 (standard deviation of 14.94) to 46.67 (standard deviation of 14.63), a difference that produced a *t-statistic* of 2.32 that was also statistically significant, p≤.05. On *Math Concepts and Application*, the SEED group achieved a posttest mean of 58.46 (standard deviation of 18.46) compared to a comparison group mean of 55.53 (standard deviation of 18.30). This difference produced a *t-statistic* of 2.02 and was again statistically significant, $p \leq .05$. As in the case of the algebra analysis, the *t-tests* used were non-directional tests for independent samples that assume equal variances, the most conservative parametric tests available. The results of this analysis are consistent with previous evaluations of SEED and with data from other districts in this study.

Since the matches for the *t-tests* were not perfect, the evaluator also computed an analysis of covariance on each of the outcome variables. The models included ethnicity, lunch status, SEED status, 1997 Reading score, and the appropriate 1997 mathematics score (97 *Math Total* for 98 *Math Total*, 97 *Math Computation* for 98 *Math Computation*, and 97 *Math Concepts and Application* for 98 *Math Concepts and Application*).

Table 5 presents the effects test from the analysis of covariance performed on the 1998 *Math Total* posttest of the *CTBS*.

Table 5
Effects Test: District 2
***Total Mathematics* Posttest-1998**

Source	df	ss	F ratio	Probability
SES (Lunch)	1	522.33	4.0092	≤.0457
Ethnicity	3	342.36	0.8759	≤.4532
SEED status	1	2947.25	22.6219	<.0001
97 Reading Comp.	1	2177.34	16.7124	<.0001
97 Math Total	1	46078.66	353.6821	<.0001

df=degrees of freedom
ss=sum of squares

Study of Table 5 suggests significant effects of pretest *Reading Comprehension* and *Math Total* scores on 1998 posttest *Math Total* scores as well as a significant effect of socioeconomic status as measured by lunch status and SEED participation on those same scores. SEED participation was a significant predictor of *Math Total* achievement, $p < .0001$.

Table 6 presents the effects test from the analysis of covariance performed on the 1998 *Math Computation* posttest.

Table 6
Effects Test: District 2
***Math Computation* Posttest-1998**

Source	df	ss	F ratio	Probability
SES (Lunch)	1	582.77	4.9152	≤.0270
Ethnicity	3	3100.01	8.7154	<.0001
SEED participation	1	2064.95	17.4164	<.0001
97 Reading Comp.	1	16126.21	136.0129	<.0001
97 Math Compu.	1	17049.44	143.7997	<.0001

df=degrees of freedom
ss=sum of squares

Study of Table 6 suggests major effects of pretest *Math Computation* scores, pretest Reading Comprehension scores, ethnicity, and SEED participation on 1998 posttest *Math Computation scores.* Socioeconomic status as measured by lunch status was also significantly related to *Math Computation.* SEED participation was again strongly related to mathematics performance, p<.0001.

Table 7 presents the effects test from the analysis of covariance performed on the 1998 *Math Concepts and Application* posttest.

Table 7
Effects Test: District 2
***Mathematics Concepts and Application* Posttest-1998**

Source	df	ss	F ratio	Probability
SES (Lunch)	1	631.40	2.2891	≤.1151
Ethnicity	3	137.30	0.1804	≤.9097
SEED participation	1	1817.02	7.1631	≤.0014
97 Reading Comp.	1	882.95	3.4808	≤.0625
97 Math Concepts	1	28523.88	112.4475	<.0001

df=degrees of freedom
ss=sum of squares

Study of Table 7 suggests major effects of pretest *Math Concepts and Application pretest* scores on 1998 posttest *Math Concepts and Applications* scores as well as a significant effect of SEED participation and the *Reading Comprehension* pretest. SEED participation was related to mathematics application, $p \leq .0014$.

Study of the data contained in Tables 5, 6, and 7 leads to the conclusion that SEED instruction contributes to increased mathematics test scores on the *California Achievement Test* among District 2 students.

Sample: District 3. 302 District 3 third grade students who had been exposed to at least fourteen weeks of SEED instruction and their 302 matched comparisons were tested with the *Math Procedures, Math Concepts / Problem Solving, Math Total*, and *Reading Comprehension* subtests of the *Metropolitan Achievement Test.* These students were tested in the Spring of 1997 and again in the Spring of 1998. Because of the unavailability of student test scores from some of the original planned comparison schools, the match was not as close as was desirable. The District 3 Research Office provided three-digit *standard scores* for third grade students from the treatment and comparison schools. The pretest *Reading Comprehension* mean *standard score* was 449.17 for the comparison group and 439.48 for the SEED group while the pretest *Math Total* mean *standard score* was 453.04 for the comparison group and 446.32 for the SEED group. The disparity in the SEED and comparison group's pretest scores required an analysis of covariance to determine program effect. A *t-test* for independent samples was also calculated so that simple, straightforward graphs of program effect could be included in the District 3 report.

Results: District 3. Even given the fact that the comparison group started higher on both measures of *Reading Comprehension* and *Total Mathematics*, SEED students outscored comparison students on all three unadjusted measures of mathematics achievement. They achieved a mean *standard score* of 470.98 with a standard deviation of 225.20 on *Math Total* as compared to a mean *standard score* of 424.57 with a standard deviation of 212.70 for the comparison group, a difference that produced a *t-statistic* of 2.60 and was statistically significant, $p \leq .01$. On *Math Concepts/Problem Solving*, the SEED group outscored the comparison group in mean *standard score* performance 491.93 (standard deviation of 217.96) to 439.78 (standard deviation of 205.92), a difference that produced a *t-statistic* of 3.02 that was also statistically significant, $p \leq .01$. On *Math Procedures*, the SEED group achieved a posttest mean of 462.37 (standard deviation of 235.62) compared to a comparison group mean of 432.45 (standard deviation of 214.77). This difference produced a *t-statistic* of 1.38 and, probably because of the large within group variances, was not statistically significant. As in the case of the algebra analysis, the *t-tests* used were non-directional tests for independent samples that assume equal variances, the most conservative parametric tests available. In all three comparisons the SEED group started behind the comparison group and ended up ahead, in two cases significantly ahead. Again, it must be emphasized that the *t-tests* were for unadjusted means making the results quite remarkable. The results of this analysis are consistent with previous evaluations of SEED and with data from other districts in this study.

Since the matches for the *t-tests* were not good and provided a major advantage for the comparison group, an analysis of covariance was also computed on each of the outcome variables. The models included student-level variables ethnicity, lunch status, gender, SEED status, 1997 Reading score, and the appropriate 1997 mathematics score (97 *Math Total* for 98 *Math Total*, 97 *Math Concepts/Problem Solving* for 98 *Math Concepts/Problem Solving*, and 97 *Math Procedures* for 98 *Math Procedures*).

Table 8 presents the effects test from the analysis of covariance performed on the 1998 *Math Total* posttest.

Table 8
Effects Test: District 3
***Total Mathematics* Posttest-1998**

Source	df	ss	F ratio	Probability
Gender	1	9158.4	0.3023	≤.5827
Ethnicity	4	240925.5	1.9878	≤.0949
Lunch (SES)	1	152183.5	5.0225	≤.0254
SEED participation	1	462737.0	15.2761	<.0001
97 Reading Comp.	1	1532178.8	50.5661	<.0001
97 Math Total	1	2420371.4	79.8788	<.0001

df=degrees of freedom
ss=sum of squares

Study of Table 8 suggests major effects of pretest *Reading Comprehension* and *Math Total* scores on 1998 posttest *Math Total* scores as well as a significant effect of SEED participation on those same scores ($p<.0001$). Socioeconomic status, as measured by participation in the free or reduced lunch program, also contributed to higher posttest mathematics scores ($p\leq.0254$). Gender and ethnicity were not significantly related to *Math Total* posttest scores.

Table 9 presents the effects test from the analysis of covariance performed on the 1998 *Math Procedures* posttest.

Table 9
Effects Test: District 3
***Mathematics Procedures* Posttest-1998**

Source	df	ss	F ratio	Probability
Gender	1	52719.3	1.5117	≤.2194
Ethnicity	4	567825.7	4.0705	≤.0029
Lunch (SES)	1	154756.5	4.4375	≤.0356
SEED participation	1	299253.3	8.5608	≤.0035
97 Reading Comp.	1	2758569.4	79.0992	<.0001
97 Math Procedure	1	1905051.7	54.6254	<.0001

df=degrees of freedom
ss=sum of squares

Study of Table 9 suggests major effects of pretest *Reading Comprehension* and *Math Procedures* scores on 1998 posttest *Math Procedures* scores as well as a significant effect of SEED participation on those same scores ($p \leq .0035$). Socioeconomic status, as measured by participation in the free or reduced lunch program, again contributed to higher posttest mathematics scores ($p \leq .0356$). Gender was not significantly related to the *Math Procedures* posttest scores but ethnicity was ($p \leq .0029$).

Table 10 presents the effects test from the analysis of covariance performed on the 1998 *Math Concepts/Problem Solving* posttest. Study of Table 10 suggests major effects of pretest *Reading Comprehension* and *Math Concepts/Problem Solving* scores on 1998 posttest *Math Concepts/Problem Solving* scores as well as a significant effect of SEED participation on those same scores ($p \leq .0001$). Socioeconomic status, as measured by participation in the free or reduced lunch program, also contributed to higher posttest mathematics scores ($p \leq .0463$), although not to nearly the same extent as SEED participation. Gender and ethnicity were not significantly related to *Math Concepts/Problem Solving* posttest scores.

Table 10
Effects Test: District 3
Math Concepts/Problem Solving Posttest-1998

Source	df	ss	F ratio	Probability
Gender	1	951.3	0.0303	≤.8618
Ethnicity	4	89212.2	0.7114	≤.5843
Lunch (SES)	1	124956.2	3.9857	≤.0463
SEED participation	1	505554.2	16.1257	<.0001
97 Reading Comp.	1	1779753.7	56.7689	<.0001
97 Math Concepts	1	1233705.1	39.3516	<.0001

df=degrees of freedom
ss=sum of squares

Taking all of the District 3 test data into account, it appears that participation in SEED instruction contributes to substantially increased mathematics test scores on the *Metropolitan Achievement Test* among District 3 students.

Since this was one of the first analyses completed and gender contributed very little to the equations, it was tested in other districts but not included in other district equations because of lack of predictive ability.

Sample: District 4. 137 District 4 fifth and sixth grade students who had been exposed to at least fourteen weeks of SEED instruction and their 149 matched comparisons were tested with the *Math Total*, and *Reading Comprehension* subtests of the *Survey Form of the Iowa Tests of Basic Skills*. These students were tested in the Spring of 1997 and again in the Spring of 1998. Table 11 presents the results of that analysis.

Results: District 4. The Project SEED group had a mean NCE score of 52.5 with a 2.1 standard error of the mean. The comparison group had a mean NCE score of 46.1 with a 2.0 standard error of the mean. These differences are both statistically and practically significant (p≤.05).

An Analysis of covariance was also computed on these data. The model included socioeconomic status as measured by free or reduced lunch, ethnicity, SEED participation, *Reading Total* 1997, and *Math Total* 1997 predicting *Math Total* 1998. Study of Table 11 suggests significant influences of *Reading Total* 1997, *Math Total*

1997, socioeconomic status, and SEED participation on 1998 *Math Total* scores. SEED participation was significant, $p \leq .0088$.

Table 11
Effects Test: District 4
***Math Total* Posttest-1998**

Source	df	ss	F ratio	Probability
Ethnicity	1	1037.93	15.3213	≤.0001
Lunch (SES)	1	46.04	0.6796	≤.4106
SEED participation	1	473.00	6.9822	≤.0088
97 Reading Total	1	1211.12	17.8777	<.0001
97 Math Total	1	7675.29	113.2979	<.0001

df=degrees of freedom
ss=sum of squares

Taking the limited available District 4 test data into account, Project SEED instruction appears to contribute to increased student mathematics performance on the *Iowa Tests of Basic Skills* among District 4 students.

Sample: District 5. 323 District 5 students who had at least fourteen weeks of SEED instruction and their 323 matched comparisons were tested in the Spring of 1997 on the *Core Battery of the Survey Form of the Iowa Tests of Basic Skills (ITBS).* Subtests used in the matching process included *Total Math with Computation* and *Advanced Skills Reading*. These students were tested again in the Spring of 1998 with the *Math Problem Solving*, *Math Procedures*, and *Total Math* subtests of the *Stanford 9*. The method of analysis was analysis of covariance, with the 1998 math subtest scores on the *Stanford 9* being the outcome measures and 1997 *Total Math with Computation*, Math *Concepts* and *Advanced Skills-Reading* scores on the *ITBS* as well as student ethnicity and student grade in 1998 being the predictors.

Results. An analysis of covariance was computed for each of the *Stanford 9* posttests. SEED students significantly outscored comparisons on two of three subtests of mathematics on the *Stanford 9*. That is, SEED students significantly outperformed comparisons on the *Math Problem Solving* and *Total Math* subtests of the *Stanford 9* while there were no differences on the Math Procedures subtest.

Table 12 presents the effects test from the analysis of covariance performed on the 1998 *Math Total* posttest of the *Stanford 9*. Predictors used in this analysis were enrollment in SEED, ethnicity, grade, and *ITBS Advanced Skills Reading and Total Math with Computation* subtests.

Table 12
Effects Test: District 5
***Total Mathematics* Posttest-1998**

Source	df	ss	F ratio	Probability
Grade	2	12348.48	50.6584	<.0001
Ethnicity	6	7581.457	10.3673	<.0001
SEED participation	1	1020.103	8.3697	≤.0039
97 Advanced Skills Reading	1	2622.742	21.5191	<.0001
97 Math Total	1	57787.774	474.1366	<.0001

df=degrees of freedom
ss=sum of squares

Study of Table 12 suggests significant effects of pretest *Reading Comprehension* and *Math Total* scores on 1998 posttest *Math Total* scores as well as a significant effect of grade, ethnicity, and SEED participation on those same scores. SEED participation was a significant predictor of *Math Total* achievement, $p \leq .0039$.

Table 13 presents the effects test from the analysis of covariance performed on the 1998 *Math Procedures* posttest.

Study of Table 13 suggests major effects of pretest *Math Total* scores and grade level on 1998 posttest *Math Procedures* scores as well as a significant effect of ethnicity and *Reading Comprehension* pretest. There was no measured effect of participation in SEED on posttest *Math Procedures* scores.

Table 13
Effects Test: District 5
Mathematics Procedures Posttest-1998

Source	df	ss	F ratio	Probability
Grade	2	3735.41	11.8344	<.0001
Ethnicity	6	5849.48	6.1774	<.0001
SEED participation	1	92.51	0.5862	≤.4442
97 Advanced Skills-Reading	1	591.21	3.7461	≤.0534
97 Math Total	1	62121.80	393.6255	<.0001

df=degrees of freedom
ss=sum of squares

Table 14 presents the effects test from the analysis of covariance performed on the 1998 *Math Concepts/Problem Solving* posttest.

Table 14
Effects Test-District 5
Math Problem Solving Posttest-1998

Source	df	ss	F ratio	Probability
Grade	2	19791.78	69.4308	<.0001
Ethnicity	6	9510.43	11.1211	<.0001
SEED participation	1	1968.15	13.8088	≤.0002
97 Advanced Skills-Reading	1	5309.11	37.2494	<.0001
97 Math Total	1	46511.25	326.3288	<.0001

df=degrees of freedom
ss=sum of squares

Study of Table 14 suggests major effects of pretest *Math Total* scores and student ethnicity on 1998 posttest *Math Concepts/Problem Solving* scores as well as significant effects of pretest *Reading Comprehension*, ethnicity, grade level *and* SEED participation on those same scores ($p \leq .001$ for SEED participation).

Taking all of the standardized test data into account, it is apparent that participation in SEED instruction contributes to increased mathematics test scores on the *Stanford 9* among District 5 students, particularly in the areas of mathematical concepts and problem solving.

Table 15 summarizes the norm-referenced achievement data from all five districts in the study.

Table 15
Summary of Mathematics Achievement Results
Five Districts, 1997-98

District	Tests Used (Criterion)	Total Math	Math Concepts	Math Computation
District 1 Grade 5 n=81	California Achievement Test	*t-test*, $p \leq .01$ F-test, $p < .0001$	*t-test*, $p \leq .01$ F-test, $p < .0001$	*t-test*, $p \leq .05$ F-test, $p \leq .0009$
District 2 Grade 4 n=322	Comprehensive Tests of Basic Skills	*t-test*, $p \leq .05$ F-test, $p < .0001$	*t-test*, $p \leq .05$ F-test, $p \leq .0014$	*t-test*, $p \leq .05$ F-test, $p < .0001$
District 3 Grade 3 n=302	Metropolitan Achievement Test	*t-test*, $p \leq .01$ F-test, $p < .0001$	*t-test*, $p \leq .01$ F-test, $p < .0001$	*t-test*, no difference F-test, $p \leq .0035$
District 4 Grades 5 - 6 n=137	Iowa Tests of Basic Skills-Survey	*t-test*, $p \leq .05$ F-test, $p < .0088$	No Data, Survey Test.	No Data, Survey Test.
District 5 Grades 4 - 6 n=323	Stanford 9 (ITBS pretest)	No *t-test* F-test, $p \leq .0039$	No *t-test* F-test, $p \leq .0002$	No *t-test* F-test, no difference

Perusal of the data in Table 15 shows that the five districts employed five different norm-referenced achievement tests, with one district (District 5), using different pre-

and posttests. In spite of the different measures of achievement, SEED students significantly outperformed non-SEED students in nine of ten *t-test* comparisons. When the analysis of covariance was applied to take into account the pre-treatment differences between groups that the sampling scheme for the *t-tests* didn't handle, the resulting F-statistics were generally much stronger and were statistically significant in twelve of thirteen comparisons. Thus, in spite of five different measures of achievement applied to students at different grade levels in five different school districts from different parts of the country, the results were very similar. SEED instruction contributed to increased scores on general measures of mathematics achievement. This occurred despite the fact that the SEED curriculum is not focused on increasing general mathematics scores on standardized tests.

Student Opinions

Sample: District 1. 429 District 1 students who had been exposed to SEED instruction were administered a seven item scale that was designed to determine their attitude toward SEED instruction as well as whether or not they perceived SEED instruction to have had impact on their general mathematics ability and on their general feeling of confidence in school.

Results: District 1. District 1 student questionnaire results are tabulated in Appendix C-1. A summary of those results suggests that, after exposure to Project SEED instruction, 98.6% of respondents enjoyed their SEED classes, 100% felt that they learned Algebra through their SEED classes, 92% felt that they liked mathematics more because of their experience with SEED, 92% believed that their mathematics abilities were stronger because of their exposure to SEED, 93% felt more confident about mathematics, and 87.6% felt more confident in school. Thus District 1 students expressed very positive attitudes about their experiences with SEED and believed that their positive SEED experience effected their overall attitude toward mathematics and school in general.

Sample: District 2. 422 District 2 students who had been exposed to SEED instruction were administered a seven item scale that was designed to determine their attitude toward SEED instruction as well as whether or not they perceived SEED instruction to have had impact on their general mathematics ability and on their general feeling of confidence in school.

Results: District 2. District 2 student questionnaire results are tabulated in Appendix C-2. A summary of those results suggests that, after exposure to Project SEED instruction, 98.6% of respondents enjoyed their SEED classes, 100% felt that they learned Algebra through their SEED classes, 90.5% felt that they liked mathematics more because of their experience with SEED, 94.5% believed that their mathematics abilities were stronger because of their exposure to SEED, 94.2% felt more confident about mathematics, and 90.6% felt more confident in school. Thus District 2 students also expressed very positive attitudes about their experiences with SEED and believed that their positive SEED experience effected their overall attitude toward mathematics and school in general.

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Sample: District 3. 462 District 3 students who had been exposed to SEED instruction were administered a seven item scale that was designed to determine their attitude toward SEED instruction as well as whether or not they perceived SEED instruction to have had impact on their general mathematics ability and on their general feeling of confidence in school.

Results: District 3. Results for District 3 students are also tabulated in Appendix C-3. A summary of those results suggests that, after exposure to Project SEED instruction, 98.1% of respondents enjoyed their SEED classes, 97.4% felt that they learned Algebra through their SEED classes, 90.9% felt that they liked mathematics more because of their experience with SEED, 92.9% believed that their mathematics abilities were stronger because of their exposure to SEED, 94% felt more confident about mathematics, and 90.7% felt more confident in school. Thus students expressed very positive attitudes about their experiences with SEED and believed that their positive SEED experience effected their overall attitude toward mathematics and school in general.

Sample: District 4. 184 District 4 students who had been exposed to SEED instruction were administered a seven item scale that was designed to determine their attitude toward SEED instruction as well as whether or not they perceived SEED instruction to have had impact on their general mathematics ability and on their general feeling of confidence in school.

Results: District 4. District 4 Student Survey results are tabulated in Appendix C-4. A summary of those results suggests that, after exposure to Project SEED instruction, 93.5% of respondents enjoyed their SEED classes, 97.4% felt that they learned Algebra through their SEED classes, 90.1% felt that they liked mathematics more because of their experience with SEED, 95% believed that their mathematics abilities were stronger because of their exposure to SEED, 87.1% felt more confident about mathematics, and 88.3% felt more confident in school. Thus District 4 students expressed very positive attitudes about their experiences with SEED and believed that their positive SEED experience effected their overall attitude toward mathematics and school in general.

Sample: District 5. 324 District 5 students who had been exposed to SEED instruction were administered a seven item scale that was designed to determine their attitude toward SEED instruction as well as whether or not they perceived SEED instruction to have had impact on their general mathematics ability and on their general feeling of confidence in school.

Results: District 5. Results of the Student Survey are tabulated in Appendix C-5. A summary of those results suggests that, after exposure to Project SEED instruction, 94.1% of respondents enjoyed their SEED classes, 97.2% felt that they learned Algebra through their SEED classes, 89.8% felt that they liked mathematics more because of their experience with SEED, 91.6% believed that their mathematics abilities were stronger because of their exposure to SEED, 88.8% felt more confident about mathematics, and 88.4% felt more confident in school. Thus District 5 students expressed very positive attitudes about their experiences with SEED and believed that their positive SEED experience effected their overall attitude toward mathematics and school in general.

Sample: All Districts. 1837 students from five urban school districts who had been exposed to SEED instruction were administered a seven item scale that was designed to determine their attitude toward SEED instruction as well as whether or not they perceived SEED instruction to have had impact on their general mathematics ability and on their general feeling of confidence in school.

Results: All Districts. Results for the total sample across districts are tabulated in Appendix C-6. A summary of those results suggests that, after exposure to Project SEED instruction, 97.2% of respondents enjoyed their SEED classes, 98.7% felt that they learned Algebra through their SEED classes, 90.9% felt that they liked mathematics more because of their experience with SEED, 93.1% believed that their mathematics abilities were stronger because of their exposure to SEED, 92.2% felt more confident about mathematics, and 89.2% felt more confident in school. Thus study students expressed very positive attitudes about their experiences with SEED and believed that their positive SEED experience effected their overall attitude toward mathematics and school in general.

Teacher Characteristics and Opinions

Sample: District 1. 27 District 1 teachers who had SEED instructors in their classrooms responded to an 18-item questionnaire about their experiences teaching mathematics and about Project SEED.

Results: District 1. Results for District 1 teachers are tabulated in Appendix D-1. Significant facts include that only 18.5% of respondents had even a college minor in mathematics while 77.8% had at least six years of teaching experience. 85.2% were experiencing their first year of SEED instruction.

In terms of observations about SEED, 65.4% of respondents believed that their experience with SEED significantly strengthened their understanding of mathematics while 96.3% believed that the SEED instructional methods were extremely effective. 100% felt that student enthusiasm and class participation was good to excellent. 88.9% of respondents observed normally shy or withdrawn students actively participating in the SEED classroom.

In response to a series of questions about the direct impact of SEED instruction on students, 91.3% of responding teachers believed that SEED stimulated student interest in mathematics considerably, 76.9% believed that student critical thinking and problem solving skills were extensively improved by SEED instruction, 85.7% believed that SEED instruction provided considerable motivation to learn, 84.6% held that student self-confidence was considerably improved, 81.9% saw significant improvement in peer relations, 77.7% observed substantial improvement in student communications skills, and 69.2% saw significant improvement in student performance in regular math classes. It should be noted that at least 93.6% of responding teachers saw at least some improvement in all of these important student traits.

In terms of the impact of SEED on the actual teaching behavior of observing teachers, 96.3% reported gaining some new or insightful way to teach mathematical concepts and 100% employed one or more SEED instructional techniques in their teaching. Finally, 96.3% of responding teachers reported that they would like to see the type of instruction employed by Project SEED in more classrooms.

Sample: District 2. 38 District 2 teachers who had SEED instructors in their classrooms responded to an 18-item questionnaire about their experiences teaching mathematics and about Project SEED.

Results: District 2. Results for District 2 teachers are tabulated in Appendix D-2. Significant facts include that 68.4% of respondents had either a college major or a minor in mathematics. This percentage was significantly higher than in any other district in this study. 86.8% had at least six years of teaching experience while 67.6% were experiencing their first year of SEED instruction.

In terms of observations about SEED, 68.4% of respondents believed that their experience with SEED significantly strengthened their understanding of mathematics while 100% felt that their understanding of mathematics was strengthened to some extent by exposure to SEED. 100% of respondents believed that the SEED instructional methods were notably effective and that student enthusiasm and class participation was good to excellent. 89.2% of respondents observed normally shy or withdrawn students actively participating in the SEED classroom.

In response to a series of questions about the direct impact of SEED instruction on students, 92.1% of responding teachers believed that SEED stimulated student interest in mathematics considerably, 86.9% believed that student critical thinking and problem solving skills were extensively improved by SEED instruction, 86.8% believed that SEED instruction provided considerable motivation to learn, 94.7% held that student self-confidence was considerably improved, 73.6% saw significant improvement in peer relations, 63.2% observed substantial improvement in student communications skills, and 57.9% saw significant improvement in student performance in regular math classes. It should be noted that 100% of responding teachers saw at least some improvement in all of these important student traits.

In terms of the impact of SEED on the actual teaching behavior of observing teachers, 94.7% reported gaining some new or insightful way to teach mathematical concepts and 97.4% employed one or more SEED instructional techniques in their teaching. Finally, 94.7% of responding teachers reported that they would like to see the type of instruction employed by Project SEED in more classrooms.

Sample: District 3. 25 District 3 teachers who had SEED instructors in their classrooms responded to an 18-item questionnaire about their experiences teaching mathematics and about Project SEED.

Results: District 3. District 3 results are also tabulated in Appendix D-3. Significant facts include that only 20% of respondents had even a college minor in mathematics while 84% had at least six years of teaching experience. 64% were experiencing their first year of SEED instruction.

In terms of observations about SEED, 72% of respondents believed that their experience with SEED significantly strengthened their understanding of mathematics while 92% believed that the SEED instructional methods were notably effective. 92% also felt that student enthusiasm and class participation was good to excellent and observed normally shy or withdrawn students actively participating in the SEED classroom.

In response to a series of questions about the direct impact of SEED instruction on students, 84% of responding teachers believed that SEED considerably stimulated student interest in mathematics, 80% believed that student critical thinking and problem solving skills were extensively improved by SEED instruction, 87.5% believed that SEED instruction provided considerable motivation to learn, 92% held that student self-confidence was considerably improved, 76% saw significant improvement in peer relations, 76% observed substantial improvement in student communications skills, and 72% saw significant improvement in student performance in regular math classes. It should be noted that at 100% of responding teachers saw at least some improvement in all of these important student traits.

In terms of the impact of SEED on the actual teaching behavior of observing teachers, 96% reported gaining some new or insightful way to teach mathematical concepts and 100% employed one or more SEED instructional techniques in their teaching. Finally, 100% of responding teachers reported that they would like to see the type of instruction employed by Project SEED in more classrooms.

Sample: District 4. Four District 4 teachers who had SEED instructors in their classrooms responded to an 18-item questionnaire about their experiences teaching mathematics and about Project SEED.

Results: District 4. District 4 teacher results are tabulated in Appendix D-4. Significant facts include that none of the respondents had even a college minor in mathematics while one was a first year teacher. That same teacher was experiencing his first year of SEED instruction. Only 4 teachers responded.

In terms of observations about SEED, 100% of respondents believed that their experience with SEED significantly strengthened their understanding of mathematics , that the SEED instructional methods were notably effective, and that student enthusiasm and class participation was good to excellent. 100% of respondents also observed normally shy or withdrawn students actively participating in the SEED classroom.

In response to a series of questions about the direct impact of SEED instruction on students, 100% of responding teachers believed that SEED stimulated student interest in mathematics considerably, 100% believed that student critical thinking and problem solving skills were extensively improved by SEED instruction, 100% believed that SEED instruction provided considerable motivation to learn, 75% held that student self-confidence was considerably improved, 75% saw significant improvement in peer relations, 75% observed substantial improvement in student communications skills, and 100% saw significant improvement in student performance in regular math classes.

In terms of the impact of SEED on the actual teaching behavior of observing teachers, 100% reported gaining some new or insightful way to teach mathematical concepts and employed one or more SEED instructional techniques in their teaching. Finally, 100% of responding District 4 teachers reported that they would like to see the type of instruction employed by Project SEED in more classrooms.

Sample: District 5. 14 District 5 teachers who had SEED instructors in their classrooms responded to an 18-item questionnaire about their experiences teaching mathematics and about Project SEED.

Results: District 5. Results of the Teacher Survey are tabulated in Appendix D-5. Significant facts include that none of the respondents had even a college minor in mathematics while only one teacher had at least six years of teaching experience. 64.3% were experiencing their first year of SEED instruction.

In terms of observations about SEED, 85.7% of respondents believed that their experience with SEED significantly strengthened their understanding of mathematics while 100% believed that the SEED instructional methods were notably effective. 100% also felt that student enthusiasm and class participation was good to excellent and observed normally shy or withdrawn students actively participating in the SEED classroom.

In response to a series of questions about the direct impact of SEED instruction on students, 71.4% of responding teachers believed that SEED considerably stimulated student interest in mathematics, 57.1% believed that student critical thinking and problem solving skills were extensively improved by SEED instruction, 64.3% believed that SEED instruction provided considerable motivation to learn, 78.5% held that student self-confidence was considerably improved, 57.2% saw significant improvement in peer relations, 28.5% observed substantial improvement in student communications skills, and 50% saw significant improvement in student performance in regular math classes. It should be noted that at 100% of responding teachers saw at least some improvement in all of these important student traits.

In terms of the impact of SEED on the actual teaching behavior of observing teachers, 100% reported gaining some new or insightful way to teach mathematical concepts and employed one or more SEED instructional techniques in their teaching. Finally, 100% of responding teachers reported that they would like to see the type of instruction employed by Project SEED in more classrooms.

Sample: All Districts. 108 public school teachers from five different urban school districts who had SEED instructors in their classrooms responded to an 18-item questionnaire about their experiences teaching mathematics and about Project SEED.

Results: All Districts. Results for the aggregate of all districts are tabulated in Appendix D-6. Significant facts include that only 10.2% of all respondents had either a college major or a minor in mathematics. Only two school districts reported having any teachers in the study that had majors or minors in mathematics. 71.3% had at least six years of teaching experience while 71% were experiencing their first year of SEED instruction.

In terms of observations about SEED, 72% of respondents believed that their experience with SEED significantly strengthened their understanding of mathematics while 99.1% felt that their understanding of mathematics was strengthened to some extent by exposure to SEED. 97.3% of respondents believed that the SEED instructional methods were notably effective and 98.2% believed that student enthusiasm and class participation was good to excellent. 91.6% of respondents observed normally shy or withdrawn students actively participating in the SEED classroom.

In response to a series of questions about the direct impact of SEED instruction on students, 87.9% of responding teachers believed that SEED considerably stimulated student interest in mathematics, 79.4% believed that student critical thinking and problem solving skills were extensively improved by SEED instruction, 85% believed that SEED instruction provided considerable motivation to learn, 88.8% held that student self-confidence was considerably improved, 74.1% saw significant improvement in peer relations, 65.7% observed substantial improvement in student communications skills, and 64.5% saw significant improvement in student performance in regular math classes. It should be noted that over 98% of responding teachers saw at least some improvement in all of these important student traits.

In terms of the impact of SEED on the actual teaching behavior of observing teachers, 96.3% reported gaining some new or insightful way to teach mathematical concepts and 99.1% employed one or more SEED instructional techniques in their teaching.

In summary, all of the teachers surveyed believed that Project SEED instruction was effective and 99.1%,believed that it increased their own understanding of mathematics, Over 96% reported benefiting from new insights in how to teach mathematics and all but one teacher reported that they utilized at least one SEED instructional strategy in their own teaching.

SEED's direct impact on student instruction was seen as increasing student enthusiasm and class participation, stimulating student interest in mathematics, motivating students to learn, improving student self-confidence, improving student peer relations, improving student communication skills, and improving student performance in mathematics. Finally, 97.2% of responding teachers reported that they would like to see the type of instruction employed by Project SEED in more classrooms.

Principal Opinions

Sample: District 1. 21 District 1 principals responded to a 15-item questionnaire about their perceptions of Project SEED. Principals who had SEED classes in either the first or second semester were included in the survey.

Results: District 1. Appendix E-1 contains the results of the Principal Survey for District 1. 61.9% of reporting principals noted that they had had SEED classes in their building for the first time. 90.4% reported observing a SEED class at least once during the year while 57.1% reported multiple observations.

90.5% of District 1 principals rated the teaching methods employed by SEED as extremely effective while 71.4% felt that student enthusiasm and participation in SEED classes was excellent. In a series of parallel questions, 100% of District 1 principals reported that the SEED lessons considerably stimulated student interest in mathematics and motivated students to learn while 90% believed that they helped improve critical thinking and problem solving skills. 95.2% reported that SEED instruction helped build student self-confidence while 80% saw significant impact on fostering better peer relationships and 76.2% reported improvement of student communication skills. No principal believed that SEED had no impact on any of these important student outcomes.

In the area of professional relationships, principals consistently rated SEED specialists highly in a number of important areas and 95.2 % believed that the SEED program positively affected the classroom teacher. Finally, 85.7% of District 1 principals would like SEED in their schools next year and 100% would like to see this kind of instruction in more classrooms.

Sample: District 2. 24 District 2 principals responded to a 15-item questionnaire about their perceptions of Project SEED.

Results: District 2. Appendix E-2 contains the results of the Principal Survey for District 2. 65.2% of reporting principals noted that they had had SEED classes in their building for more than one year. 95.8% reported observing a SEED class at least once during the year while 70.8% reported multiple observations.

100% of District 2 principals rated the teaching methods employed by SEED as extremely effective while 95.8% felt that student enthusiasm and participation in SEED classes was excellent. In a series of parallel questions, 100% of District 2 principals reported that the SEED lessons considerably stimulated student interest in mathematics, 95.9 % believed that they greatly motivated students to learn, 83.3% held that they significantly helped improve critical thinking and problem solving skills, 87.5% recounted that they notably helped build student self-confidence, 85.7% saw significant impact on fostering better peer relationships, and 78.3% detected significant improvement in student communication skills. All principals believed that SEED had some impact on every one of these important student outcomes except one principal saw little impact on communication skills.

In the area of professional relationships, principals consistently rated SEED specialists highly in a number of important areas and 100 % believed that the SEED program positively affected the classroom teacher. Finally, 100% of District 2 principals would like SEED in their schools next year and 100% would like to see this kind of instruction in more classrooms.

Sample: District 3. Nine District 3 principals responded to a 15-item questionnaire about their perceptions of Project SEED. The principal response rate was probably low because District 3 principals responded to a similar survey a few years ago. Responses to this survey were very similar to the responses tabulated for the previous survey and attained very similar results.

Results: District 3. Appendix E-3 contains results of the District 3 Principal Survey. 100% of reporting principals noted that they had had SEED classes in their building for more than one year. 100% reported observing a SEED class at least once during the year while 62.5% reported multiple observations.

100% of District 3 principals rated the teaching methods employed by SEED as extremely effective while 88.9% felt that student enthusiasm and participation in SEED classes was excellent. In a series of parallel questions, 100% of District 3 principals reported that the SEED lessons considerably stimulated student interest in mathematics, motivated students to learn, helped improve critical thinking and problem solving skills, and helped build student self-confidence, while 88.9% saw significant impact on fostering better peer relationships and the improvement of student communication skills. No principal believed that SEED had no impact on any of these important student outcomes.

In the area of professional relationships, principals consistently rated SEED specialists highly in a number of important areas and 100 % believed that the SEED program positively affected the classroom teacher. Finally, 100% of District 3 principals would like SEED in their schools next year and 100% would like to see this kind of instruction in more classrooms.

Sample: District 4. Seven District 4 principals responded to a 15-item questionnaire about their perceptions of Project SEED.

Results: District 4. Appendix E-4 contains the results of the Principal Survey. No reporting principals noted that they were in their first year of having SEED classes in their building. 100% reported observing a SEED class at least once during the year while 85.7% reported multiple observations.

Over 85% 0f District 4 principals rated the teaching methods employed by SEED as extremely effective while 85.7% felt that student enthusiasm and participation in SEED classes was excellent. In a series of parallel questions, 100% of District 4 principals reported that the SEED lessons considerably stimulated student interest in mathematics, built student self-confidence, and motivated students to learn, while over 85% saw significant impact on the improvement of critical thinking and problem solving skills. 71.5% believed that SEED instruction contributed to better student communication skills while 57.2% believed that it fostered better peer relationships. No principal believed that SEED had no impact on any of these important student outcomes.

In the area of professional relationships, principals consistently rated SEED specialists highly in a number of important areas and 100 % believed that the SEED program positively affected the classroom teacher. Finally, 100% of District 4 principals would like SEED in their schools next year and 100% would like to see this kind of instruction in more classrooms.

Sample: District 5. Eight District 5 principals responded to a 15-item questionnaire about their perceptions of Project SEED.

Results: District 5. Appendix E 5 contains the results of the survey for District 5. 62.5% of reporting principals noted that they had had SEED classes in their building for more than one year. 100% reported observing a SEED class at least once during the year while 87.5% reported multiple observations.

100% of District 5 principals rated the teaching methods employed by SEED as extremely effective while 71.4% felt that student enthusiasm and participation in SEED classes was excellent. In a series of parallel questions, 100% of District 5 principals reported that the SEED lessons considerably stimulated student interest in mathematics, 75.0 % believed that they greatly motivated students to learn, 87.5% held that they significantly helped improve critical thinking and problem solving skills, 87.5% recounted that they notably helped build student self-confidence, 62.5% saw significant impact on fostering better peer relationships, and 87.5% detected significant improvement in student communication skills. All principals believed that SEED had some impact on every one of these important student outcomes.

In the area of professional relationships, principals consistently rated SEED specialists highly in a number of important areas and 100 % believed that the SEED program positively affected the classroom teacher. Finally, 100% of District 5 principals would like SEED in their schools next year and 100% would like to see this kind of instruction in more classrooms.

Sample: All Districts. 69 principals from five school districts responded to a 15-item questionnaire about their perceptions of Project SEED.

Results: All Districts. Appendix E-6 contains the results of the Principal Survey tabulated across all districts in the study. 64.1% of reporting principals noted that they had had SEED classes in their building for more than one year. 95.6% reported observing a SEED class at least once during the year while 69.1% reported multiple observations.

95.7% of sampled principals rated the teaching methods employed by SEED as extremely effective while 83.8% felt that student enthusiasm and participation in SEED classes was excellent. In a series of parallel questions, 100% of responding principals reported that the SEED lessons considerably stimulated student interest in mathematics, 95.5 % believed that they greatly motivated students to learn, 88.3% held that they significantly helped improve critical thinking and problem solving skills, 92.8% recounted that they notably helped build student self-confidence, 82.1% saw significant impact on fostering better peer relationships, and 79.4% detected significant improvement in student communication skills. All principals believed that SEED had some impact on every one of these important student outcomes except one principal saw little impact on communication skills.

In the area of professional relationships, principals consistently rated SEED specialists highly in a number of important areas and 98.5% believed that the SEED program positively affected the classroom teacher.

In summary, principals from five different school districts were very positive toward Project SEED and its specialists. They generally felt that SEED instruction was extremely effective, that it exerted a positive effect on the classroom teacher, that it motivated and stimulated students to learn mathematics, improved critical thinking and problem solving skills, and helped build student self-confidence and communications skills. Finally, 95.7% of involved principals would like SEED in their schools next year and 100% would like to see this kind of instruction in more classrooms.

Parent Opinions

Sample: District 1. 241 parents of District 1 students enrolled in SEED classes responded to a short questionnaire about Project SEED.

Results: District 1. Appendix F-1 contains the results of the Parent Survey for District 1. 45.1% of parents reported observing a Project SEED class. 85.1% said that their children were very excited about studying Algebra through Project SEED, 86.7% reported that their children greatly enjoyed SEED classes, 75.1 % observed that their children's confidence had significantly improved since exposure to SEED, and 71.4% believed that their children's math ability had notably improved after exposure to SEED. Finally, 88.7% felt that other children should be exposed to SEED.

Sample: District 2. 157 parents of District 2 students enrolled in SEED classes responded to a short questionnaire about Project SEED.

Results: District 2. Appendix F-2 contains the results of the Parent Survey for District 2. 36.9% of parents reported observing a Project SEED class. 84.9% said that their children were very excited about studying Algebra through Project SEED, 88% reported that their children greatly enjoyed SEED classes, 64.8 % observed that their children's confidence had significantly improved since exposure to SEED, and 62.3% believed that their children's math ability had notably improved after exposure to SEED. Finally, 90.5% felt that other children should be exposed to SEED.

Sample: District 3. 267 parents of District 3 students enrolled in SEED classes responded to a short questionnaire about Project SEED.

Results: District 3. Appendix F-3 contains the District 3 results of the Parent Survey. 40.4% of parents reported observing a Project SEED class. 90.6% said that their children were very excited about studying Algebra through Project SEED, 92.2% reported that their children greatly enjoyed SEED classes, 76.7% observed that their children's confidence had significantly improved since exposure to SEED, and 75.5% believed that their children's math ability had notably improved after exposure to SEED. Finally, 94.8% felt that other children should be exposed to SEED.

Sample: District 4. 59 parents of District 4 students enrolled in SEED classes responded to a short questionnaire about Project SEED.

Results: District 4. Appendix F-4 contains the results of the Parent Survey for District 4. 40.7% of parents reported observing a Project SEED class. 78% said that their children were very excited about studying Algebra through Project SEED, 79.6% reported that their children greatly enjoyed SEED classes, 70.7 % observed that their children's confidence had improved significantly since exposure to SEED, and 66.7% believed that their children's math ability had notably improved after exposure to SEED. Finally, 77.2% felt that other children should be exposed to SEED.

Sample: District 5. 136 parents of District 5 students enrolled in SEED classes responded to a short questionnaire about Project SEED.

Results: District 5. Appendix F-5 contains the results of the Parent Survey for District 5. 22.1% of parents reported observing a Project SEED class. 74.3% said that their children were very excited about studying Algebra through Project SEED, 78% reported that their children greatly enjoyed SEED classes, 78.2 % observed that their children's confidence had significantly improved since exposure to SEED, and 63.9% believed that their children's math ability had notably improved after exposure to SEED. Finally, 86.8% felt that other children should be exposed to SEED.

Sample: All Districts. 856 parents of students enrolled in SEED classes in five different school districts responded to a short questionnaire about Project SEED.

Results: All Districts. Appendix F-6 contains the aggregate results of the Parent Survey across all five districts. 38.2% of parents reported observing a Project SEED class. 84.6% said that their children were very excited about studying Algebra through

Project SEED, 87% reported that their children greatly enjoyed SEED classes, 70.7 % observed that their children's confidence had significantly improved since exposure to SEED, and 69.2% believed that their children's math ability had notably improved after exposure to SEED. Finally, 89.9% felt that other children should be exposed to SEED.

Summary

Principals, classroom teachers, and parents of SEED students all believed that the SEED program provided significant value-added benefit to SEED students. In addition, principals and teachers believed that the classroom teacher benefited from witnessing SEED instruction, both from the standpoint of improved teaching methodology and strengthened understanding of mathematics.

SEED instruction was generally seen to be extremely effective accompanied by high rates of student participation and enthusiasm. Among the noted outcomes of SEED instruction were increased student interest in mathematics, improved critical thinking and problem solving skills, increased student motivation to learn, increased student self-confidence, and better understanding of mathematics. Student performance on five different nationally normed achievement tests as well as on the Algebra tests administered through this evaluation support these observations as well as point to increased student achievement levels in mathematics.

Students themselves reported enjoying their Project SEED Algebra classes, believed that they had learned Algebra through their SEED classes (an observation that is backed up by empirical data), liked mathematics more because of SEED, felt that their mathematical abilities were strengthened as a result of SEED, and reported notably increased feelings of confidence about mathematics and school in general.

This study was a cooperative study conducted across and within five school districts. These districts included Camden City School District in New Jersey, the Dallas Public Schools in Texas, the Detroit Public Schools in Michigan, the Indianapolis Public Schools in Indiana, and the West Contra Costa School District in Richmond and San Pablo, California. Results across these five districts were strikingly similar in terms of both cognitive impact of the program on student mastery of algebraic concepts and the strong support for the program from classroom teachers, principals, students, and parents. Perhaps the greatest measure of support for the program is that, across the five districts, 97.2% of classroom teachers and 100% of principals, polled by anonymous survey, said that they would like to see this type of instruction in more classrooms. In addition, 95.7% of principals reported that they would like SEED in their schools next year while 89.9% of the parents of SEED students believed that other children should be exposed to SEED. The amount of parental interest in the program is attested to by the fact that an unusually high 38.2% of parents across the five districts visited and observed a SEED class.

Successful programs in education are rare. Successful educational programs that have grassroots support are practically unique. From all of the data that have been analyzed across a number of different districts throughout a period of more than thirty years, SEED appears to be one of those unique programs. The findings of this study have supported the findings of previous studies. Project SEED has a positive impact on student achievement and attitudes toward school and mathematics as well as a positive impact on the instructional and mathematical abilities of observing teachers.

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Appendix A

PROJECT SEED

POSTTEST QUESTIONS 1997 - 98

Level A: Abstract Algebra (Group Theory)

Appendix A

PROJECT SEED

POSTTEST QUESTIONS 1997 - 98

Level A: Abstract Algebra (Group Theory)

Directions: On your blue answer sheet, darken the circle that best answers the question. Attempt all problems but do not spend too much time on any one answer. Please notice that the questions start with number 51.

Hints: In this test,

I_+ stands for 0, the additive identity and

$I_\times$ stands for 1, the multiplicative identity.

51. If $\alpha + I_+ = \alpha$, then $I_+ =$

A) α
B) 0
C) 1
D) 9

52. $7 + I_+ + 3 + I_+ = \boxed{}$

A) 12
B) 10
C) 28
D) $10I_+$

53. ▱ $+ 19 + I_+ = 29$

A) 48
B) I_+
C) 9
D) 10

54. $^-\alpha + \beta + \alpha + {}^-\beta + 6 = \boxed{}$

A) 6
B) $^-\beta$
C) α
D) $^-6$

55. $\square + 7 + 3 = 3$

A) 13
B) 7
C) $^-7$
D) 10

56. $^-6 + 5 + 6 + {}^-5 + 8 + {}^-9 + {}^-8 + 9 = \triangle$

A) $^-28$
B) 28
C) 56
D) I_+

57. $8 + \square = {}^-7$

A) 1
B) $^-1$
C) 15
D) $^-15$

58. $^-17 + 20 = \triangle$

A) 3
B) 37
C) $^-37$
D) $^-3$

59. $\square + {}^-2 + {}^-4 = 0$

A) $^-6$
B) I_+
C) 6
D) $\frac{1}{6}$

60. If $^-5 + {}^-2 + p = 0$, then $p =$

A) $^-7$
B) 7
C) $^-3$
D) 3

61. If $\alpha \times I_x = \alpha$, then $I_x =$

A) α
B) 0
C) 1
D) 9

62. $I_x \times 6 \times \square = 6$

A) 0
B) $^-6$
C) 7
D) I_x

63. $(8 + I_+) \times I_x = \triangle$

A) 0
B) 8
C) 9
D) 10

64. $5 \times \frac{1}{5} = \bigcirc$

A) 1
B) $5\frac{1}{5}$
C) 5
D) $\frac{1}{25}$

65. $\alpha \times \frac{1}{\alpha} = \triangleleft$, (for $\alpha \neq 0$)

A) $\frac{1}{\alpha}$
B) 2α
C) 1
D) $\frac{1}{2}\alpha$

66. $\frac{1}{2} \times$ ▱ $\times \frac{1}{\beta} \times \beta = 1$, (for $\beta \neq 0$)

A) 2β
B) 0
C) 1
D) 2

67. $\frac{1}{2} \times \frac{1}{3} \times$ ▽ $= 1$

A) $\frac{1}{6}$
B) 6
C) 5
D) $\frac{2}{5}$

68. ⬠ $\times\ 9 = 3$

A) $\frac{1}{3}$
B) $\frac{1}{9}$
C) 3
D) 6

69. $(^{-}2 \times 3) + (^{-}2 \times 5) =$ ◿ $\times (3 + 5)$

A) $^{-}2$
B) 4
C) $^{-}6$
D) $^{-}10$

70. $(\frac{1}{2} \times 4) + (\frac{1}{2} \times 6) = \frac{1}{2} \times$ ⯃

A) 2
B) 10
C) 3
D) 5

Appendix B

PROJECT SEED

POSTTEST QUESTIONS 1997 - 98

Level B: Exponentiation

Appendix B

PROJECT SEED

POSTTEST QUESTIONS 1997 - 98

Level B: Exponentiation

Directions: On your blue answer sheet, darken the circle that best answers the question. Attempt all problems but do not spend too much time on any one answer. Please notice that the questions start with number 51.

Hint: In this test, E stands for the operation of exponentiation, so xEy stands for x^y.

51. If α E 5 = α^5, then in the expression α E 5, α is the

A) factor form.
B) exponent.
C) operation.
D) base.

52. 4 E 3 = ⬠

A) 4 x 3
B) 4 x 4 x 4
C) 4 + 4 + 4
D) 3 x 3 x 3 x 3

53. 2^4 = ⬡

A) 2 x 2 x 2 x 2
B) 8 x 8 x 8 x 8
C) $\frac{2 \times 2}{4}$
D) 2 x 4

54. The factor form for β E 3 is

A) $\beta \times \beta \times \beta$
B) 6
C) $\beta \times 3$
D) β

55. 2 E □ = 64

A) 32
B) 2
C) 6
D) 62

56. If h E 7 = 128, then h = ◿

A) 121
B) 135
C) 2
D) 3

57. If $7^m = 49$, then m = □

A) 7
B) 2
C) 42
D) 56

58. 3^4 = ⬠

A) 81
B) 12
C) 30
D) 18

59. (α E γ) x (α E β) = ⬡

A) α E (γ + β)
B) α E (γx β)
C) (α x α) E (γ x β)
D) α E (γ E β)

60. If γ^n x $\gamma^5 = \gamma^{12}$, then n = ◁

A) 17
B) δ
C) 7
D) 60

61. ( ) x ( ) = 4 E 6

A) (4 E 5) x (4 E 1)
B) (4 E 2) x (4 E 3)
C) (2 E 3) x (2 E 2)
D) (4 E 1) x (4 E 6)

62. (5 E 4) ÷ (5 E ◁) = 5 E 1

A) 4
B) $\frac{1}{4}$
C) 3
D) 1

63. $(2^3)^4$ = ▭

A) $2^3 \times 2^3 \times 2^3 \times 2^3$
B) 2^7
C) 6^4
D) 2^4

64. (6 E 3) E □ = 6 E 15

A) 12
B) 5
C) 10
D) 15

65. (16 E $\frac{1}{4}$) x (16 E $\frac{1}{4}$) x (16 E $\frac{1}{4}$) x (16 E $\frac{1}{4}$) = ⌂

A) 16 E 1
B) 16 E $\frac{4}{16}$
C) $\frac{4}{16}$
D) 64 E 1

66. $7^{\frac{1}{2}} \times 7^{\frac{1}{2}}$ = ⬠

A) $7^{\frac{2}{4}}$
B) 7^1
C) 2
D) 49^1

67. $81 \text{ E } \frac{1}{2} = $ ▱

A) $\frac{81}{2}$
B) 9
C) 40
D) 84

68. $\sqrt{\square} = 5$

A) 2.5
B) 5
C) 10
D) 25

69. In the expression $\log_2 256$, the 2 is the

A) variable
B) base
C) exponent
D) argument

70. $\text{Log}_2 8 + \text{Log}_2 16 = $ ◇

A) 48
B) 12
C) 24
D) 7

Appendix C

Project SEED Student Survey

Appendix C-1

Project SEED Student Survey

District 1

1. **My class has Project SEED algebra lessons in the ...**

a.	morning	245	57.1
b.	afternoon	184	42.9

2. **I enjoy my Project SEED algebra class.**

a.	Yes, a whole lot	326	76.2
b.	Yes, somewhat	96	22.4
c.	Not true	6	1.4

3. **I have learned about Algebra through my Project SEED class.**

a.	Yes, a whole lot	366	85.5
b.	Yes, somewhat	62	14.5
c.	Not true	0	0

4. **I like mathematics more due to my experience with Project SEED algebra.**

a.	Yes, a whole lot	257	60.0
b.	Yes, somewhat	137	32.0
c.	Not true	34	8.0

5. **My mathematics abilities are stronger due to my experience with Project SEED algebra.**

a.	Yes, a whole lot	246	57.6
b.	Yes, somewhat	147	34.4
c.	Not true	34	8.0

6. **I feel more confident about doing mathematics due to my experience with Project SEED algebra.**

a.	Yes, a whole lot	270	63.1
b.	Yes, somewhat	128	29.9
c.	Not true	30	7.0

7. **I feel more confident in school due to my experience with Project SEED algebra.**

a.	Yes, a whole lot	252	59.0
b.	Yes, somewhat	122	28.6
c.	Not true	53	12.4

Appendix C-2

Project SEED Student Survey

District 2

1. **My class has Project SEED algebra lessons in the ...**

a.	morning	230	54.5
b.	afternoon	192	45.5

2. **I enjoy my Project SEED algebra class.**

a.	Yes, a whole lot	345	82.3
b.	Yes, somewhat	68	16.3
c.	Not true	6	1.4

3. **I have learned about Algebra through my Project SEED class.**

a.	Yes, a whole lot	373	88.8
b.	Yes, somewhat	47	11.2
c.	Not true	0	0

4. **I like mathematics more due to my experience with Project SEED algebra.**

a.	Yes, a whole lot	293	69.8
b.	Yes, somewhat	87	20.7
c.	Not true	40	9.5

5. **My mathematics abilities are stronger due to my experience with Project SEED algebra.**

a.	Yes, a whole lot	303	72.3
b.	Yes, somewhat	93	22.2
c.	Not true	23	5.5

6. **I feel more confident about doing mathematics due to my experience with Project SEED algebra.**

a.	Yes, a whole lot	324	77.5
b.	Yes, somewhat	70	16.7
c.	Not true	24	5.7

7. **I feel more confident in school due to my experience with Project SEED algebra.**

a.	Yes, a whole lot	274	65.8
b.	Yes, somewhat	103	24.8
c.	Not true	39	9.4

Appendix C-3

Project SEED Student Survey

District 3

1. **My class has Project SEED algebra lessons in the ...**

a.	morning	196	45.4
b.	afternoon	266	61.6

2. **I enjoy my Project SEED algebra class.**

a.	Yes, a whole lot	423	92.6
b.	Yes, somewhat	25	5.5
c.	Not true	9	1.9

3. **I have learned about Algebra through my Project SEED class.**

a.	Yes, a whole lot	404	89.2
b.	Yes, somewhat	37	8.2
c.	Not true	12	2.6

4. **I like mathematics more due to my experience with Project SEED algebra.**

a.	Yes, a whole lot	345	76.3
b.	Yes, somewhat	66	14.6
c.	Not true	41	9.1

5. **My mathematics abilities are stronger due to my experience with Project SEED algebra.**

a.	Yes, a whole lot	340	75.7
b.	Yes, somewhat	77	17.2
c.	Not true	32	7.1

6. **I feel more confident about doing mathematics due to my experience with Project SEED algebra.**

a.	Yes, a whole lot	346	77.1
b.	Yes, somewhat	76	16.9
c.	Not true	27	6.0

7. **I feel more confident in school due to my experience with Project SEED algebra.**

a.	Yes, a whole lot	333	75.3
b.	Yes, somewhat	68	15.4
c.	Not true	41	9.3

Appendix C-4

Project SEED Student Survey

District 4

1. **My class has Project SEED algebra lessons in the ...**

a.	morning	152	82.6
b.	afternoon	32	17.4

2. **I enjoy my Project SEED algebra class.**

a.	Yes, a whole lot	122	66.3
b.	Yes, somewhat	50	27.2
c.	Not true	12	6.5

3. **I have learned about Algebra through my Project SEED class.**

a.	Yes, a whole lot	150	81.5
b.	Yes, somewhat	31	16.9
c.	Not true	3	1.6

4. **I like mathematics more due to my experience with Project SEED algebra.**

a.	Yes, a whole lot	102	55.7
b.	Yes, somewhat	63	34.4
c.	Not true	18	9.8

5. **My mathematics abilities are stronger due to my experience with Project SEED algebra.**

a.	Yes, a whole lot	117	64.6
b.	Yes, somewhat	55	30.4
c.	Not true	9	5.0

6. **I feel more confident about doing mathematics due to my experience with Project SEED algebra.**

a.	Yes, a whole lot	106	59.2
b.	Yes, somewhat	50	27.9
c.	Not true	23	12.9

7. **I feel more confident in school due to my experience with Project SEED algebra.**

a.	Yes, a whole lot	112	62.2
b.	Yes, somewhat	47	26.1
c.	Not true	21	11.7

Appendix C-5

Project SEED Student Survey

District 5

1. **My class has Project SEED algebra lessons in the ...**

a.	morning	228	70.4
b.	afternoon	96	29.6

2. **I enjoy my Project SEED algebra class.**

a.	Yes, a whole lot	188	58.2
b.	Yes, somewhat	116	35.9
c.	Not true	19	5.9

3. **I have learned about Algebra through my Project SEED class.**

a.	Yes, a whole lot	236	73.1
b.	Yes, somewhat	78	24.1
c.	Not true	9	2.8

4. **I like mathematics more due to my experience with Project SEED algebra.**

a.	Yes, a whole lot	185	57.1
b.	Yes, somewhat	106	32.7
c.	Not true	33	10.2

5. **My mathematics abilities are stronger due to my experience with Project SEED algebra.**

a.	Yes, a whole lot	171	53.3
b.	Yes, somewhat	123	38.3
c.	Not true	27	8.4

6. **I feel more confident about doing mathematics due to my experience with Project SEED algebra.**

a.	Yes, a whole lot	179	55.4
b.	Yes, somewhat	108	33.4
c.	Not true	36	11.2

7. **I feel more confident in school due to my experience with Project SEED algebra.**

a.	Yes, a whole lot	185	58.2
b.	Yes, somewhat	96	30.2
c.	Not true	37	11.6

Appendix C-6

Project SEED Student Survey

Five School Districts

1. My class has Project SEED algebra lessons in the ...

a.	morning	1067	58.1
b.	afternoon	770	41.9

2. I enjoy my Project SEED algebra class.

a.	Yes, a whole lot	1416	77.5
b.	Yes, somewhat	359	19.7
c.	Not true	52	2.8

3. I have learned about Algebra through my Project SEED class.

a.	Yes, a whole lot	1541	84.5
b.	Yes, somewhat	259	14.2
c.	Not true	24	1.3

4. I like mathematics more due to my experience with Project SEED algebra.

a.	Yes, a whole lot	1188	65.2
b.	Yes, somewhat	468	25.7
c.	Not true	167	9.1

5. My mathematics abilities are stronger due to my experience with Project SEED algebra.

a.	Yes, a whole lot	1187	65.5
b.	Yes, somewhat	500	27.6
c.	Not true	126	6.9

6. I feel more confident about doing mathematics due to my experience with Project SEED algebra.

a.	Yes, a whole lot	1235	68.1
b.	Yes, somewhat	437	24.1
c.	Not true	141	7.8

7. I feel more confident in school due to my experience with Project SEED algebra.

a.	Yes, a whole lot	1166	64.8
b.	Yes, somewhat	438	24.4
c.	Not true	195	10.8

Appendix D

Project SEED Teacher Survey

Appendix D-1

Project SEED Teacher Survey

District 1

1. **How many years have you had Project SEED classes?**

a___	1 year	23	85.2
b___	2 years	4	14.8
c___	3 or more years	0	0

2. **How many years have you been teaching?**

a___	1 year	2	7.4
b___	2-5 years	4	14.8
c___	6-10 years	7	25.9
d___	11 or more years	14	51.9

3. **How much college mathematics do you have?**

a___	Major in mathematics	0	0
b___	Minor in mathematics	5	18.5
c___	Some courses in mathematics	21	77.8
d___	No courses in mathematics	1	3.7

4. **Has Project SEED instruction strengthened your understanding of mathematics?**

a___	Yes, a great deal	11	42.3
b___	Yes, quite a lot	6	23.1
c___	Somewhat	8	30.8
d___	Not at all	1	3.8

5. **How effective are the teaching methods employed by the Project SEED instructor?**

a___	Extremely effective	14	51.9
b___	Very effective	12	44.4
c___	Somewhat effective	1	3.7
d___	Not effective	0	0

6. **How would you rate student enthusiasm and participation during the Project SEED instruction?**

a___	Excellent	19	70.4
b___	Good	8	29.6
c___	Average	0	0
d___	Poor	0	0

7. Do you have any shy or withdrawn students who participated actively in the Project SEED lessons?

a___	Yes	24	88.9
b___	No	3	11.1

8. How well do the Project SEED lessons stimulate student interest in mathematics?

a___	A great deal	14	53.8
b___	Quite a lot	10	38.5
c___	Somewhat	1	3.8
d___	Not at all	1	3.8

9. Have the Project SEED lessons helped your students improve their critical thinking and problem solving skills?

a___	Yes, a great deal	11	42.3
b___	Yes, quite a lot	9	34.6
c___	Somewhat	5	19.2
d___	Not at all	1	3.8

10. Does Project SEED motivate students to learn?

a___	Yes, a great deal	10	35.7
b___	Yes, quite a lot	14	50.0
c___	Somewhat	3	16.7
d___	Not at all	1	3.6

11. How well do the Project SEED lessons build students' self-confidence?

a___	A great deal	13	50.0
b___	Quite a lot	9	34.6
c___	Somewhat	4	15.4
d___	Not at all	0	0

12. Does Project SEED help students to relate to their peers more positively?

a___	Yes, a great deal	8	29.6
b___	Yes, quite a lot	14	51.9
c___	Somewhat	3	11.1
d___	Not at all	2	7.4

13. Have you seen improvement in the communication skills of students: good listening, speaking clearly, using vocabulary, etc.?

a___	Yes, a great deal	8	29.6
b___	Yes, quite a lot	13	48.1
c___	Somewhat	5	18.5
d___	Not at all	1	3.7

14. Did the Project SEED lessons improve your student's performance in their regular math program?

a___	Yes, a great deal	7	26.9
b___	Yes, quite a lot	11	42.3
c___	Somewhat	7	26.9
d___	Not at all	1	3.8
e___	I do not teach math to this class	0	0

15. If you have noticed any carryover effects of Project SEED such as respectfulness, interest in learning, communication skills or thinking skills into other subjects, please describe.

16. Did the Project SEED lessons provide you with any new or insightful ways of teaching mathematical concepts?

a___	Yes	26	96.3
b___	No	1	3.7

17. Which of the following techniques have you employed in your own teaching? (Check as many items as are appropriate)

a___	Agreement and Disagreement Signals	24	88.9
b___	Deliberate Errors	19	70.4
c___	Chorus Reading	13	48.1
d___	Having Students Indicate Answers On Their Fingers	6	22.2
e___	Having A Student Call On Another Student	20	74.1
f___	Exploring The Thinking Behind "Wrong Answers So As To Give Credit For Thoughtful Answers Even Though They May Be Technically Incorrect	21	77.8
g___	None	0	0

18. Would you like to see this type of instruction in more classrooms?

a___	Yes	26	96.3
b___	No	1	3.7

Appendix D-2

Project SEED Teacher Survey

District 2

1. **How many years have you had Project SEED classes?**

a___	1 year	25	67.6
b___	2 years	3	8.1
c___	3 or more years	9	24.3

2. **How many years have you been teaching?**

a___	1 year	0	0
b___	2-5 years	5	13.2
c___	6-10 years	10	26.3
d___	11 or more years	23	60.5

3. **How much college mathematics do you have?**

a___	Major in mathematics	7	18.4
b___	Minor in mathematics	19	50.0
c___	Some courses in mathematics	12	31.6
d___	No courses in mathematics	0	0

4. **Has Project SEED instruction strengthened your understanding of mathematics?**

a___	Yes, a great deal	7	18.4
b___	Yes, quite a lot	19	50.0
c___	Somewhat	12	31.6
d___	Not at all	0	0

5. **How effective are the teaching methods employed by the Project SEED instructor?**

a___	Extremely effective	26	68.4
b___	Very effective	12	31.6
c___	Somewhat effective	0	0
d___	Not effective	0	0

6. **How would you rate student enthusiasm and participation during the Project SEED instruction?**

a___	Excellent	29	76.3
b___	Good	9	23.7
c___	Average	0	0
d___	Poor	0	0

14. Did the Project SEED lessons improve your student's performance in their regular math program?

a___	Yes, a great deal	5	13.2
b___	Yes, quite a lot	17	44.7
c___	Somewhat	16	42.1
d___	Not at all	0	0
e___	I do not teach math to this class	0	0

15. If you have noticed any carryover effects of Project SEED such as respectfulness, interest in learning, communication skills or thinking skills into other subjects, please describe.

16. Did the Project SEED lessons provide you with any new or insightful ways of teaching mathematical concepts?

a___	Yes	36	94.7
b___	No	2	5.3

17. Which of the following techniques have you employed in your own teaching? (Check as many items as are appropriate)

a___	Agreement and Disagreement Signals	33	86.8
b___	Deliberate Errors	25	5.7
c___	Chorus Reading	29	76.3
d___	Having Students Indicate Answers On Their Fingers	26	68.4
e___	Having A Student Call On Another Student	29	76.3
f___	Exploring The Thinking Behind "Wrong Answers" So As To Give Credit For Thoughtful Answers Even Though They May Be Technically Incorrect	24	63.2
g___	None	1	2.6

18. Would you like to see this type of instruction in more classrooms?

a___	Yes	36	94.7
b___	No	2	5.3

Appendix D-3

Project SEED Teacher Survey

District 3

1. **How many years have you had Project SEED classes?**

a___	1 year	16	64.0
b___	2 years	2	8.0
c___	3 or more years	7	28.0

2. **How many years have you been teaching?**

a___	1 year	0	0
b___	2-5 years	4	16.0
c___	6-10 years	3	12.0
d___	11 or more years	18	72.0

3. **How much college mathematics do you have?**

a___	Major in mathematics	1	4.0
b___	Minor in mathematics	4	16.0
c___	Some courses in mathematics	20	80.0
d___	No courses in mathematics	0	0

4. **Has Project SEED instruction strengthened your understanding of mathematics?**

a___	Yes, a great deal	9	36.0
b___	Yes, quite a lot	9	36.0
c___	Somewhat	7	28.0
d___	Not at all	0	0

5. **How effective are the teaching methods employed by the Project SEED instructor?**

a___	Extremely effective	19	76.0
b___	Very effective	4	16.0
c___	Somewhat effective	2	8.0
d___	Not effective	0	0

6. **How would you rate student enthusiasm and participation during the Project SEED instruction?**

a___	Excellent	17	68.0
b___	Good	6	24.0
c___	Average	2	8.0
d___	Poor	0	0

7. **Do you have any shy or withdrawn students who participated actively in the Project SEED lessons?**

a___	Yes	23	92.0
b___	No	2	8.0

8. **How well do the Project SEED lessons stimulate student interest in mathematics?**

a___	A great deal	14	56.0
b___	Quite a lot	7	28.0
c___	Somewhat	4	16.0
d___	Not at all	0	0

9. **Have the Project SEED lessons helped your students improve their critical thinking and problem solving skills?**

a___	Yes, a great deal	10	40.0
b___	Yes, quite a lot	10	40.0
c___	Somewhat	5	20.0
d___	Not at all	0	0

10. **Does Project SEED motivate students to learn?**

a___	Yes, a great deal	11	45.8
b___	Yes, quite a lot	10	41.7
c___	Somewhat	3	12.5
d___	Not at all	0	0

11. **How well do the Project SEED lessons build students' self-confidence?**

a___	A great deal	13	52.0
b___	Quite a lot	10	40.0
c___	Somewhat	2	8.0
d___	Not at all	0	0

12. **Does Project SEED help students to relate to their peers more positively?**

a___	Yes, a great deal	6	24.0
b___	Yes, quite a lot	13	52.0
c___	Somewhat	6	24.0
d___	Not at all	0	0

13. **Have you seen improvement in the communication skills of students: good listening, speaking clearly, using vocabulary, etc.?**

a___	Yes, a great deal	9	36.0
b___	Yes, quite a lot	10	40.0
c___	Somewhat	6	24.0
d___	Not at all	0	0

14. Did the Project SEED lessons improve your student's performance in their regular math program?

a___	Yes, a great deal	8	32.0
b___	Yes, quite a lot	10	40.0
c___	Somewhat	5	20.0
d___	Not at all	0	0
e___	I do not teach math to this class	2	8.0

15. If you have noticed any carryover effects of Project SEED such as respectfulness, interest in learning, communication skills or thinking skills into other subjects, please describe.

16. Did the Project SEED lessons provide you with any new or insightful ways of teaching mathematical concepts?

a___	Yes	24	96.0
b___	No	1	4.0

17. Which of the following techniques have you employed in your own teaching? (Check as many items as are appropriate)

a___	Agreement and Disagreement Signals	22	88.0
b___	Deliberate Errors	14	56.0
c___	Chorus Reading	17	68.0
d___	Having Students Indicate Answers On Their Fingers	15	60.0
e___	Having A Student Call On Another Student	19	76.0
f ___	Exploring The Thinking Behind "Wrong Answers"	17	68.0
g___	None	0	0

18. Would you like to see this type of instruction in more classrooms?

a___	Yes	25	100.00
b___	No	0	0

Appendix D-4

Project SEED Teacher Survey

District 4

1. **How many years have you had Project SEED classes?**

a___ 1 year	3	75.0
b___ 2 years	0	0
c___ 3 or more years	1	25.0

2. **How many years have you been teaching?**

a___ 1 year	1	25.0
b___ 2-5 years	2	50.0
c___ 6-10 years	0	0
d___ 11 or more years	1	25.0

3. **How much college mathematics do you have?**

a___ Major in mathematics	0	0
b___ Minor in mathematics	0	0
c___ Some courses in mathematics	4	100.0
d___ No courses in mathematics	0	0

4. **Has Project SEED instruction strengthened your understanding of mathematics?**

a___ Yes, a great deal	3	75.0
b___ Yes, quite a lot	1	25.0
c___ Somewhat	0	0
d___ Not at all	0	0

5. **How effective are the teaching methods employed by the Project SEED instructor?**

a___ Extremely effective	2	50.0
b___ Very effective	2	50.0
c___ Somewhat effective	0	0
d___ Not effective	0	0

6. **How would you rate student enthusiasm and participation during the Project SEED instruction?**

a___ Excellent	2	50.0
b___ Good	2	50.0
c___ Average	0	0
d___ Poor	0	0

7. **Do you have any shy or withdrawn students who participated actively in the Project SEED lessons?**

a___	Yes	4	100.0
b___	No	0	0

8. **How well do the Project SEED lessons stimulate student interest in mathematics?**

a___	A great deal	2	50.0
b___	Quite a lot	2	50.0
c___	Somewhat	0	0
d___	Not at all	0	0

9. **Have the Project SEED lessons helped your students improve their critical thinking and problem solving skills?**

a___	Yes, a great deal	2	50.0
b___	Yes, quite a lot	2	50.0
c___	Somewhat	0	0
d___	Not at all	0	0

10. **Does Project SEED motivate students to learn?**

a___	Yes, a great deal	3	75.0
b___	Yes, quite a lot	1	25.0
c___	Somewhat	0	0
d___	Not at all	0	0

11. **How well do the Project SEED lessons build students' self-confidence?**

a___	A great deal	3	75.0
b___	Quite a lot	0	0
c___	Somewhat	1	25.0
d___	Not at all	0	0

12. **Does Project SEED help students to relate to their peers more positively?**

a___	Yes, a great deal	2	50.0
b___	Yes, quite a lot	1	25.0
c___	Somewhat	1	25.0
d___	Not at all	0	0

13. **Have you seen improvement in the communication skills of students: good listening, speaking clearly, using vocabulary, etc.?**

a___	Yes, a great deal	2	50.0
b___	Yes, quite a lot	1	25.0
c___	Somewhat	1	25.0
d___	Not at all	0	0

14. Did the Project SEED lessons improve your student's performance in their regular math program?

a___	Yes, a great deal	4	100.0
b___	Yes, quite a lot	0	0
c___	Somewhat	0	0
d___	Not at all	0	0
e___	I do not teach math to this class	0	0

15. If you have noticed any carryover effects of Project SEED such as respectfulness, interest in learning, communication skills or thinking skills into other subjects, please describe.

16. Did the Project SEED lessons provide you with any new or insightful ways of teaching mathematical concepts?

a___	Yes	4	100.0
b___	No	0	0

17. Which of the following techniques have you employed in your own teaching? (Check as many items as are appropriate)

a___	Agreement and Disagreement Signals	3	75.0
b___	Deliberate Errors	2	50.0
c___	Chorus Reading	2	50.0
d___	Having Students Indicate Answers On Their Fingers	4	100.0
e___	Having A Student Call On Another Student	3	75.0
f___	Exploring The Thinking Behind "Wrong Answers" So As To Give Credit For Thoughtful Answers Even Though They May Be Technically Incorrect	3	75.0
g___	None	0	0

18. Would you like to see this type of instruction in more classrooms?

a___	Yes	4	100.0
b___	No	0	0

Project Appendix D-5

SEED Teacher Survey

District 5

1. **How many years have you had Project SEED classes?**

a___	1 year	9	64.3
b___	2 years	4	28.6
c___	3 or more years	1	7.1

2. **How many years have you been teaching?**

a___	1 year	5	35.7
b___	2-5 years	8	57.1
c___	6-10 years	1	7.1
d___	11 or more years	0	0

3. **How much college mathematics do you have?**

a___	Major in mathematics	0	0
b___	Minor in mathematics	0	0
c___	Some courses in mathematics	11	78.6
d___	No courses in mathematics	3	21.4

4. **Has Project SEED instruction strengthened your understanding of mathematics?**

a___	Yes, a great deal	4	28.6
b___	Yes, quite a lot	8	57.1
c___	Somewhat	2	14.3
d___	Not at all	0	0

5. **How effective are the teaching methods employed by the Project SEED instructor?**

a___	Extremely effective	3	1.4
b___	Very effective	11	78.6
c___	Somewhat effective	0	0
d___	Not effective	0	0

6. **How would you rate student enthusiasm and participation during the Project SEED instruction?**

a___	Excellent	2	14.3
b___	Good	12	85.7
c___	Average	0	0
d___	Poor	0	0

7. **Do you have any shy or withdrawn students who participated actively in the Project SEED lessons?**

a___ Yes	14	100.0
b___ No	0	0

8. **How well do the Project SEED lessons stimulate student interest in mathematics?**

a___ A great deal	3	21.4
b___ Quite a lot	7	50.0
c___ Somewhat	4	28.6
d___ Not at all	0	0

9. **Have the Project SEED lessons helped your students improve their critical thinking and problem solving skills?**

a___ Yes, a great deal	3	21.4
b___ Yes, quite a lot	5	35.7
c___ Somewhat	6	42.9
d___ Not at all	0	0

10. **Does Project SEED motivate students to learn?**

a___ Yes, a great deal	3	21.4
b___ Yes, quite a lot	6	42.9
c___ Somewhat	5	35.7
d___ Not at all	0	0

11. **How well do the Project SEED lessons build students' self-confidence?**

a___ A great deal	3	21.4
b___ Quite a lot	8	57.1
c___ Somewhat	3	21.4
d___ Not at all	0	0

12. **Does Project SEED help students to relate to their peers more positively?**

a___ Yes, a great deal	2	14.3
b___ Yes, quite a lot	6	42.9
c___ Somewhat	6	42.9
d___ Not at all	0	0

13. **Have you seen improvement in the communication skills of students: good listening, speaking clearly, using vocabulary, etc.?**

a___ Yes, a great deal	1	7.1
b___ Yes, quite a lot	3	21.4
c___ Somewhat	10	71.4
d___ Not at all	0	0

14. Did the Project SEED lessons improve your student's performance in their regular math program?

a___	Yes, a great deal	3	21.4
b___	Yes, quite a lot	4	28.6
c___	Somewhat	7	50.0
d___	Not at all	0	0
e___	I do not teach math to this class	0	0

15. If you have noticed any carryover effects of Project SEED such as respectfulness, interest in learning, communication skills or thinking skills into other subjects, please describe.

16. Did the Project SEED lessons provide you with any new or insightful ways of teaching mathematical concepts?

a___	Yes	14	100.0
b___	No	0	0

17. Which of the following techniques have you employed in your own teaching? (Check as many items as are appropriate)

a___	Agreement and Disagreement Signals	14	100.0
b___	Deliberate Errors	10	71.4
c___	Chorus Reading	10	71.4
d___	Having Students Indicate Answers On Their Fingers	13	92.9
e___	Having A Student Call On Another Student	11	78.6
f___	Exploring The Thinking Behind "Wrong Answers" So As To Give Credit For Thoughtful Answers Even Though They May Be Technically Incorrect	13	92.9
g___	None	0	0

18. Would you like to see this type of instruction in more classrooms?

a___	Yes	14	100.0
b___	No	0	0

Appendix D-6

Project SEED Teacher Survey

Five School Districts

1. How many years have you had Project SEED classes?

a___	1 year	76	71.0
b___	2 years	13	12.1
c___	3 or more years	18	16.8

2. How many years have you been teaching?

a___	1 year	8	7.4
b___	2-5 years	23	21.3
c___	6-10 years	21	19.4
d___	11 or more years	56	51.9

3. How much college mathematics do you have?

a___	Major in mathematics	2	1.9
b___	Minor in mathematics	9	8.3
c___	Some courses in mathematics	92	85.2
d___	No courses in mathematics	5	4.6

4. Has Project SEED instruction strengthened your understanding of mathematics?

a___	Yes, a great deal	34	31.8
b___	Yes, quite a lot	43	40.2
c___	Somewhat	29	27.1
d___	Not at all	1	0.9

5. How effective are the teaching methods employed by the Project SEED instructor?

a___	Extremely effective	64	59.3
b___	Very effective	41	38.0
c___	Somewhat effective	3	2.8
d___	Not effective	0	0

6. How would you rate student enthusiasm and participation during the Project SEED instruction?

a___	Excellent	69	63.9
b___	Good	37	34.3
c___	Average	2	1.9
d___	Poor	0	0

7. Do you have any shy or withdrawn students who participated actively in the Project SEED lessons?

a___ Yes	98	91.6
b___ No	9	8.4

8. How well do the Project SEED lessons stimulate student interest in mathematics?

a___ A great deal	49	45.8
b___ Quite a lot	45	42.1
c___ Somewhat	12	11.2
d___ Not at all	1	0.9

9. Have the Project SEED lessons helped your students improve their critical thinking and problem solving skills?

a___ Yes, a great deal	50	46.7
b___ Yes, quite a lot	35	32.7
c___ Somewhat	21	19.6
d___ Not at all	1	0.9

10. Does Project SEED motivate students to learn?

a___ Yes, a great deal	44	41.1
b___ Yes, quite a lot	47	43.9
c___ Somewhat	16	15.0
d___ Not at all	0	0

11. How well do the Project SEED lessons build students' self-confidence?

a___ A great deal	52	48.6
b___ Quite a lot	43	40.2
c___ Somewhat	12	11.2
d___ Not at all	0	0

12. Does Project SEED help students to relate to their peers more positively?

a___ Yes, a great deal	29	26.9
b___ Yes, quite a lot	51	47.2
c___ Somewhat	26	24.1
d___ Not at all	2	1.9

13. Have you seen improvement in the communication skills of students: good listening, speaking clearly, using vocabulary, etc.?

a___ Yes, a great deal	32	29.6
b___ Yes, quite a lot	39	36.1
c___ Somewhat	36	33.3
d___ Not at all	1	0.9

14. Did the Project SEED lessons improve your student's performance in their regular math program?

a___ Yes, a great deal	27	25.2
b___ Yes, quite a lot	42	39.3
c___ Somewhat	35	32.7
d___ Not at all	1	0.9
e___ I do not teach math to this class	2	1.9

15. If you have noticed any carryover effects of Project SEED such as respectfulness, interest in learning, communication skills or thinking skills into other subjects, please describe.

16. Did the Project SEED lessons provide you with any new or insightful ways of teaching mathematical concepts?

a___ Yes	104	96.3
b___ No	4	3.7

17. Which of the following techniques have you employed in your own teaching? (Check as many items as are appropriate)

a___Agreement and Disagreement Signals	96	88.9
b___Deliberate Errors	70	64.8
c___Chorus Reading	71	65.7
d___Having Students Indicate Answers On Their Fingers	64	59.3
e___Having A Student Call On Another Student	82	75.9
f___Exploring The Thinking Behind "Wrong Answers" So As To Give Credit For Thoughtful Answers Even Though They May Be Technically Incorrect	78	72.2
g___None	1	0.9

18. Would you like to see this type of instruction in more classrooms?

a___ Yes	105	97.2
b___ No	3	2.8

Appendix E

Project SEED Principal Survey

Appendix E-1

Project SEED Principal Survey

District 1

1. **How many years have you had Project SEED classes?**

a___ 1 year	13	61.9
b___ 2 years	7	33.3
c___ 3 or more years	1	4.8

2. **Did you observe Project SEED this year?**

a___ Yes, once	7	33.3
b___ Yes, more than once	12	57.1
c___ No	2	9.5

3. **How effective are the teaching methods employed by the Project SEED instructors?**

a___ Extremely effective	19	90.5
b___ Somewhat effective	2	9.5
c___ Not very effective	0	0
d___ Not effective at all	0	0

4. **How would you rate student enthusiasm and participation during the Project SEED instruction?**

a___ Excellent	15	71.4
b___ Good	6	28.6
c___ Fair	0	0
d___ Poor	0	0

5. **How well do the Project SEED lessons stimulate student interest in mathematics?**

a___ A great deal	11	52.4
b___ Quite a lot	10	47.6
c___ Somewhat	0	0
d___ Not at all	0	0

6. **Have the Project SEED lessons helped students improve their critical thinking and problem solving skills?**

a___ A great deal	6	30.0
b___ Quite a lot	12	60.0
c___ Somewhat	2	10.0
d___ Not much	0	0

7. **Does Project SEED help motivate students to learn?**

a___ A great deal	9	47.4
b___ Quite a lot	10	53.6
c___ Somewhat	0	0
d___ Not much	0	0

8. **How well do the Project SEED lessons build student self-confidence?**

a___ A great deal	12	57.1
b___ Quite a lot	8	38.1
c___ Somewhat	1	4.8
d___ Not much	0	0

9. **Does Project SEED help students to relate to their peers more positively?**

a___ A great deal	6	30.0
b___ Quite a lot	10	50.0
c___ Somewhat	4	20.0
d___ Not much	0	0

10. **Has Project SEED helped students improve in their communication skills: good listening, speaking clearly, using vocabulary, etc.?**

a___ A great deal	9	42.9
b___ Quite a lot	7	33.3
c___ Somewhat	5	23.8
d___ Not much	0	0

11. **Do you feel that the Project SEED program affects the classroom teacher positively?**

a___ Yes	20	95.2
b___ No	1	4.8

12. **On a five-point scale (1 to 5), how would you rate the Project SEED Specialist. Five being the top of the scale.**

a___Professional	4.95
b___Positive	4.62
c___Enthusiastic	4.62
d___High Expectations	4.68
e___Prepared	4.53
f___Motivating	4.90
g___Professional	4.84
h___Friendly	4.31

13. Would you like to see Project SEED in your school next year?

a___	Yes	18	85.7
b___	No	3	14.3

14. Would you like to see this kind of instruction in more classrooms in other schools?

a___	Yes	21	100.00
b___	No	0	0

Appendix E-2

Project SEED Principal Survey

District 2

1. **How many years have you had Project SEED classes?**

a___	1 year	8	34.8
b___	2 years	7	30.4
c___	3 or more years	8	34.8

2. **Did you observe Project SEED this year?**

a___	Yes, once	6	25.0
b___	Yes, more than once	17	70.8
c___	No	1	4.2

3. **How effective are the teaching methods employed by the Project SEED instructors?**

a___	Extremely effective	24	100.0
b___	Somewhat effective	0	0
c___	Not very effective	0	0
d___	Not effective at all	0	0

4. **How would you rate student enthusiasm and participation during the Project SEED instruction?**

a___	Excellent	23	95.8
b___	Good	1	4.2
c___	Fair	0	0
d___	Poor	0	0

5. **How well do the Project SEED lessons stimulate student interest in mathematics?**

a___	A great deal	16	66.7
b___	Quite a lot	8	33.3
c___	Somewhat	0	0
d____	Not at all	0	0

6. **Have the Project SEED lessons helped students improve their critical thinking and problem solving skills?**

a___	A great deal	11	45.8
b___	Quite a lot	9	37.5
c___	Somewhat	4	16.7
d___	Not much	0	0

7. **Does Project SEED help motivate students to learn?**

a___	A great deal	13	54.2
b___	Quite a lot	10	41.7
c___	Somewhat	1	4.2
d___	Not much	0	0

8. **How well do the Project SEED lessons build student self-confidence?**

a___	A great deal	14	58.3
b___	Quite a lot	7	29.2
c___	Somewhat	3	12.5
d___	Not much	0	0

9. **Does Project SEED help students to relate to their peers more positively?**

a___	A great deal	12	52.2
b___	Quite a lot	10	43.5
c___	Somewhat	1	4.3
d___	Not much	0	0

10. **Has Project SEED helped students improve in their communication skills: good listening, speaking clearly, using vocabulary, etc.?**

a___	A great deal	10	43.5
b___	Quite a lot	8	34.8
c___	Somewhat	4	17.4
d___	Not much	1	4.3

11. **Do you feel that the Project SEED program affects the classroom teacher positively?**

a___	Yes	24	100.0
b___	No	0	0

12. **On a five-point scale (1 to 5), how would you rate the Project SEED Specialist. Five being the top of the scale.**

a___	Professional	4.87
b___	Positive	4.87
c___	Enthusiastic	4.61
d___	High Expectations	4.78
e___	Prepared	4.83
f ___	Motivating	5.00
g___	Professional	5.00
h___	Friendly	5.00

13. Would you like to see Project SEED in your school next year?

a___ Yes	24	100.0
b___ No	0	0

14. Would you like to see this kind of instruction in more classrooms in other schools?

a___ Yes	24	100.0
b___ No	0	0

Appendix E-3

Project SEED Principal Survey

District 3

1. **How many years have you had Project SEED classes?**

a___	1 year	0	0
b___	2 years	2	22.2
c___	3 or more years	7	77.8

2. **Did you observe Project SEED this year?**

a___	Yes, once	3	37.5
b___	Yes, more than once	5	62.5
c___	No	0	0

3. **How effective are the teaching methods employed by the Project SEED instructors?**

a___	Extremely effective	9	100.0
b___	Somewhat effective	0	0
c___	Not very effective	0	0
d___	Not effective at all	0	0

4. **How would you rate student enthusiasm and participation during the Project SEED instruction?**

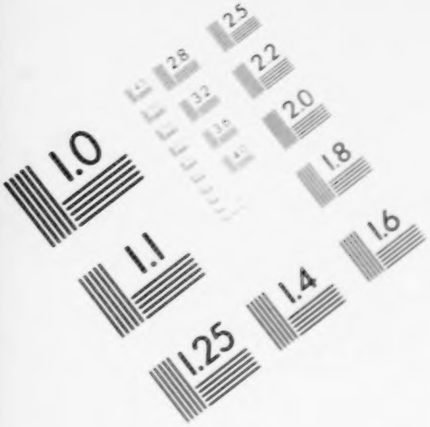
a___	Excellent	8	88.9
b___	Good	1	11.1
c___	Fair	0	0
d___	Poor	0	0

5. **How well do the Project SEED lessons stimulate student interest in mathematics?**

a___	A great deal	7	77.8
b___	Quite a lot	2	22.2
c___	Somewhat	0	0
d_____	Not at all	0	0

6. **Have the Project SEED lessons helped students improve their critical thinking and problem solving skills?**

a___	A great deal	5	55.6
b___	Quite a lot	4	44.4
c___	Somewhat	0	0
d___	Not much	0	0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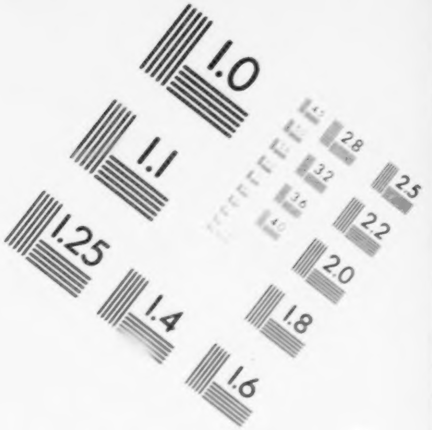
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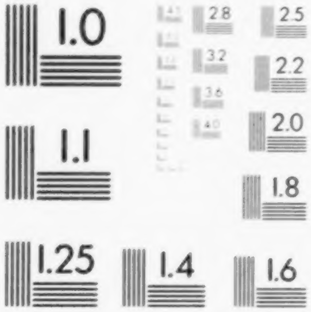
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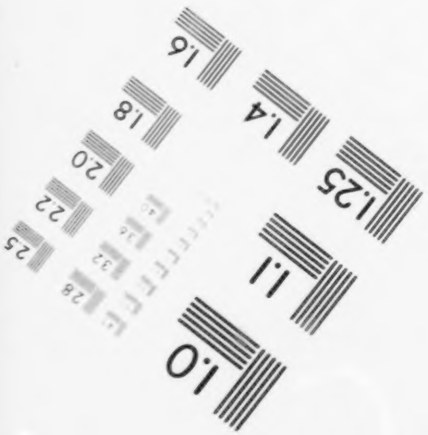
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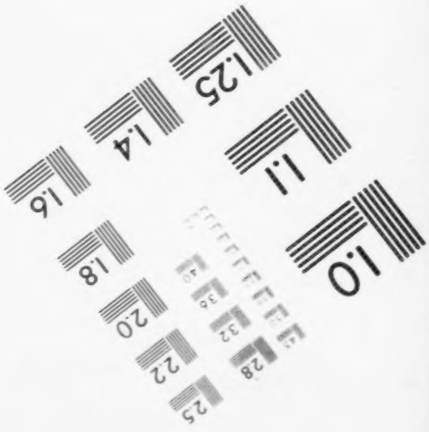
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7. Does Project SEED help motivate students to learn?

a___	A great deal	5	55.6
b___	Quite a lot	4	44.4
c___	Somewhat	0	0
d___	Not much	0	0

8. How well do the Project SEED lessons build student self-confidence?

a___	A great deal	6	66.7
b___	Quite a lot	3	33.3
c___	Somewhat	0	0
d___	Not much	0	0

9. Does Project SEED help students to relate to their peers more positively?

a___	A great deal	6	66.7
b___	Quite a lot	2	22.2
c___	Somewhat	1	11.1
d___	Not much	0	0

10. Has Project SEED helped students improve in their communication skills: good listening, speaking clearly, using vocabulary, etc.?

a___	A great deal	5	55.6
b___	Quite a lot	3	33.3
c___	Somewhat	1	11.1
d___	Not much	0	0

11. Do you feel that the Project SEED program affects the classroom teacher positively?

a___	Yes	9	100.0
b___	No	0	0

12. On a five-point scale (1 to 5), how would you rate the Project SEED Specialist. Five being the top of the scale.

a___	Professional	5.00
b___	Positive	5.00
c___	Enthusiastic	4.78
d___	High Expectations	4.67
e___	Prepared	5.00
f ___	Motivating	4.88
g___	Professional	5.00
h___	Friendly	5.00

13. Would you like to see Project SEED in your school next year?

a___ Yes	9	100.0
b___ No	0	0

14. Would you like to see this kind of instruction in more classrooms in other schools?

a___ Yes	9	100.0
b___ No	0	0

Appendix E-4

Project SEED Principal Survey

District 4

1. **How many years have you had Project SEED classes?**

a___ 1 year	0	0
b___ 2 years	3	50.0
c___ 3 or more years	3	50.0

2. **Did you observe Project SEED this year?**

a___ Yes, once	1	14.3
b___ Yes, more than once	6	85.7
c___ No	0	0

3. **How effective are the teaching methods employed by the Project SEED instructors?**

a___ Extremely effective	6	85.7
b___ Somewhat effective	1	14.3
c___ Not very effective	0	0
d___ Not effective at all	0	0

4. **How would you rate student enthusiasm and participation during the Project SEED instruction?**

a___ Excellent	6	85.7
b___ Good	1	14.3
c___ Fair	0	0
d___ Poor	0	0

5. **How well do the Project SEED lessons stimulate student interest in mathematics?**

a___ A great deal	5	71.4
b___ Quite a lot	2	28.6
c___ Somewhat	0	0
d_____ Not at all	0	0

6. **Have the Project SEED lessons helped students improve their critical thinking and problem solving skills?**

a___ A great deal	3	42.9
b___ Quite a lot	3	42.9
c___ Somewhat	1	14.3
d___ Not much	0	0

7. **Does Project SEED help motivate students to learn?**

a___	A great deal	5	71.4
b___	Quite a lot	2	28.6
c___	Somewhat	0	0
d___	Not much	0	0

8. **How well do the Project SEED lessons build student self-confidence?**

a___	A great deal	3	42.9
b___	Quite a lot	4	57.1
c___	Somewhat	0	0
d___	Not much	0	0

9. **Does Project SEED help students to relate to their peers more positively?**

a___	A great deal	2	28.6
b___	Quite a lot	2	28.6
c___	Somewhat	3	42.9
d___	Not much	0	0

10. **Has Project SEED helped students improve in their communication skills: good listening, speaking clearly, using vocabulary, etc.?**

a___	A great deal	2	28.6
b___	Quite a lot	3	42.9
c___	Somewhat	2	28.6
d___	Not much	0	0

11. **Do you feel that the Project SEED program affects the classroom teacher positively?**

a___	Yes	6	100.0
b___	No	0	0

12. **On a five-point scale (1 to 5), how would you rate the Project SEED Specialist. Five being the top of the scale.**

a___	Professional	5.00
b___	Positive	5.00
c___	Enthusiastic	4.71
d___	High Expectations	5.00
e___	Prepared	5.00
f___	Motivating	4.86
g___	Professional	5.00
h___	Friendly	4.86

13. Would you like to see Project SEED in your school next year?

a___	Yes	7	100.0
b___	No	0	0

14. Would you like to see this kind of instruction in more classrooms in other schools?

a___	Yes	7	100.0
b___	No	0	0

Appendix E-5

Project SEED Principal Survey

District 5

1. **How many years have you had Project SEED classes?**

a___	1 year	3	37.5
b___	2 years	2	25.0
c___	3 or more years	3	37.5

2. **Did you observe Project SEED this year?**

a___	Yes, once	1	12.5
b___	Yes, more than once	7	87.5
c___	No	0	0

3. **How effective are the teaching methods employed by the Project SEED instructors?**

a___	Extremely effective	8	100.0
b___	Somewhat effective	0	0
c___	Not very effective	0	0
d___	Not effective at all	0	0

4. **How would you rate student enthusiasm and participation during the Project SEED instruction?**

a___	Excellent	5	71.4
b___	Good	2	28.6
c___	Fair	0	0
d___	Poor	0	0

5. **How well do the Project SEED lessons stimulate student interest in mathematics?**

a___	A great deal	4	50.0
b___	Quite a lot	4	50.0
c___	Somewhat	0	0
d_____	Not at all	0	0

6. **Have the Project SEED lessons helped students improve their critical thinking and problem solving skills?**

a___	A great deal	3	37.5
b___	Quite a lot	4	50.0
c___	Somewhat	1	12.5
d___	Not much	0	0

7. Does Project SEED help motivate students to learn?

a___	A great deal	3	37.5
b___	Quite a lot	3	37.5
c___	Somewhat	2	25.0
d___	Not much	0	0

8. How well do the Project SEED lessons build student self-confidence?

a___	A great deal	3	37.5
b___	Quite a lot	4	50.0
c___	Somewhat	1	12.5
d___	Not much	0	0

9. Does Project SEED help students to relate to their peers more positively?

a___	A great deal	3	37.5
b___	Quite a lot	2	25.0
c___	Somewhat	3	37.5
d___	Not much	0	0

10. Has Project SEED helped students improve in their communication skills: good listening, speaking clearly, using vocabulary, etc.?

a___	A great deal	3	37.5
b___	Quite a lot	4	50.0
c___	Somewhat	1	12.5
d___	Not much	0	0

11. Do you feel that the Project SEED program affects the classroom teacher positively?

a___	Yes	8	100.0
b___	No	0	0

12. On a five-point scale (1 to 5), how would you rate the Project SEED Specialist. Five being the top of the scale.

a___	Professional	5.00
b___	Positive	4.86
c___	Enthusiastic	4.86
d___	High Expectations	4.86
e___	Prepared	5.00
f___	Motivating	4.57
g___	Professional	5.00
h___	Friendly	5.00

13. Would you like to see Project SEED in your school next year?

a___ Yes	8	100.0
b___ No	0	0

14. Would you like to see this kind of instruction in more classrooms in other schools?

a___ Yes	8	100.0
b___ No	0	0

Appendix E-6

Project SEED Principal Survey

Five School Districts

1. How many years have you had Project SEED classes?

a___	1 year	24	35.8
b___	2 years	21	31.3
c___	3 or more years	22	32.8

2. Did you observe Project SEED this year?

a___	Yes, once	18	26.5
b___	Yes, more than once	47	69.1
c___	No	3	4.4

3. How effective are the teaching methods employed by the Project SEED instructors?

a___	Extremely effective	66	95.7
b___	Somewhat effective	3	4.3
c___	Not very effective	0	0
d___	Not effective at all	0	0

4. How would you rate student enthusiasm and participation during the Project SEED instruction?

a___	Excellent	57	83.8
b___	Good	11	16.2
c___	Fair	0	0
d___	Poor	0	0

5. How well do the Project SEED lessons stimulate student interest in mathematics?

a___	A great deal	43	62.3
b___	Quite a lot	26	37.7
c___	Somewhat	0	0
d____	Not at all	0	0

6. Have the Project SEED lessons helped students improve their critical thinking and problem solving skills?

a___	A great deal	28	41.2
b___	Quite a lot	32	47.1
c___	Somewhat	8	11.8
d___	Not much	0	0

7. Does Project SEED help motivate students to learn?

a___ A great deal	35	52.2
b___ Quite a lot	29	43.3
c___ Somewhat	3	4.5
d___ Not much	0	0

8. How well do the Project SEED lessons build student self-confidence?

a___ A great deal	38	55.1
b___ Quite a lot	26	37.7
c___ Somewhat	5	7.2
d___ Not much	0	0

9. Does Project SEED help students to relate to their peers more positively?

a___ A great deal	29	43.3
b___ Quite a lot	26	38.8
c___ Somewhat	12	17.9
d___ Not much	0	0

10. Has Project SEED helped students improve in their communication skills: good listening, speaking clearly, using vocabulary, etc.?

a___ A great deal	29	42.6
b___ Quite a lot	25	36.8
c___ Somewhat	13	19.1
d___ Not much	1	1.5

11. Do you feel that the Project SEED program affects the classroom teacher positively?

a___ Yes	67	98.5
b___ No	1	2.5

12. On a five-point scale (1 to 5), how would you rate the Project SEED Specialist. Five being the top of the scale.

a___ Professional	4.94
b___ Positive	5.00
c___ Enthusiastic	4.82
d___ High Expectations	4.83
e___ Prepared	4.83
f___ Motivating	4.89
g___ Professional	4.94
h___ Friendly	4.85

13. Would you like to see Project SEED in your school next year?

a___ Yes	66	95.7
b___ No	3	4.3

14. Would you like to see this kind of instruction in more classrooms in other schools?

a___ Yes	69	100.00
b___ No	0	0

Appendix F
Project SEED Parent Survey

Appendix F-1
Project SEED Parent Survey

District 1

1. **I have observed a Project SEED class.**

a___	Yes	107	45.1
b___	No	130	54.9

2. **My child is excited about studying Algebra through Project SEED.**

a___	Yes, a great deal	159	66.0
b___	Yes, quite a lot	46	19.1
c___	Yes, somewhat	27	11.2
d___	No, not at all	1	0.4
e___	I don't know	8	3.3

3. **My child enjoys the Project SEED classes.**

a___	Yes, a great deal	150	62.2
b___	Yes, quite a lot	59	24.5
c___	Yes, somewhat	26	10.8
d___	No, not at all	1	0.4
e___	I don't know	5	2.1

4. **My child's confidence has improved since exposure to Project SEED.**

a___	Yes, a great deal	111	46.1
b___	Yes, quite a lot	70	29.0
c___	Yes, somewhat	37	15.4
d___	No, not at all	6	2.5
e___	I don't know	17	7.1

5. **My child's math ability has improved since exposure to SEED.**

a___	Yes, a great deal	104	43.2
b___	Yes, quite a lot	68	28.2
c___	Yes, somewhat	47	19.5
d___	No, not at all	12	5.0
e___	I don't know	10	4.1

6. **Other children should be exposed to SEED.**

a___	Yes	212	88.7
b___	No	1	0.4
c___	I don't know	26	10.9

Appendix F-2

Project SEED Parent Survey

District 2

1. I have observed a Project SEED class.

a___ Yes	58	36.9
b___ No	99	63.1

2. My child is excited about studying Algebra through Project SEED.

a___ Yes, a great deal	95	59.7
b___ Yes, quite a lot	40	25.2
c___ Yes, somewhat	18	11.3
d___ No, not at all	3	1.9
e___ I don't know	3	1.9

3. My child enjoys the Project SEED classes.

a___ Yes, a great deal	105	66.0
b___ Yes, quite a lot	35	22.0
c___ Yes, somewhat	15	9.4
d___ No, not at all	2	1.3
e___ I don't know	2	1.3

4. My child's confidence has improved since exposure to Project SEED.

a___ Yes, a great deal	65	40.9
b___ Yes, quite a lot	38	23.9
c___ Yes, somewhat	47	29.6
d___ No, not at all	3	1.9
e___ I don't know	6	3.8

5. My child's math ability has improved since exposure to SEED.

a___ Yes, a great deal	48	30.2
b___ Yes, quite a lot	51	32.1
c___ Yes, somewhat	45	28.3
d___ No, not at all	8	5.0
e___ I don't know	7	4.4

6. Other children should be exposed to SEED.

a___ Yes	143	90.5
b___ No	0	0
c___ I don't know	15	9.5

Appendix F-3
Project SEED Parent Survey

District 3

1. **I have observed a Project SEED class.**

a___	Yes	108	40.4
b___	No	159	59.6

2. **My child is excited about studying Algebra through Project SEED.**

a___	Yes, a great deal	181	67.5
b___	Yes, quite a lot	62	23.1
c___	Yes, somewhat	19	7.1
d___	No, not at all	0	0
e___	I don't know	6	2.2

3. **My child enjoys the Project SEED classes.**

a___	Yes, a great deal	198	73.2
b___	Yes, quite a lot	51	19.0
c___	Yes, somewhat	15	5.6
d___	No, not at all	2	0.7
e___	I don't know	2	0.7

4. **My child's confidence has improved since exposure to Project SEED.**

a___	Yes, a great deal	140	52.4
b___	Yes, quite a lot	65	24.3
c___	Yes, somewhat	54	20.2
d___	No, not at all	2	0.7
e___	I don't know	6	2.2

5. **My child's math ability has improved since exposure to SEED.**

a___	Yes, a great deal	132	49.4
b___	Yes, quite a lot	67	25.1
c___	Yes, somewhat	52	19.5
d___	No, not at all	7	2.6
e___	I don't know	9	3.4

6. **Other children should be exposed to SEED.**

a___	Yes	254	94.8
b___	No	3	1.1
c___	I don't know	11	4.1

Appendix F-4

Project SEED Parent Survey

District 4

1. **I have observed a Project SEED class.**

a___	Yes	24	40.7
b___	No	35	59.3

2. **My child is excited about studying Algebra through Project SEED.**

a___	Yes, a great deal	37	62.7
b___	Yes, quite a lot	9	15.3
c___	Yes, somewhat	10	16.9
d___	No, not at all	3	5.1
e___	I don't know	0	0

3. **My child enjoys the Project SEED classes.**

a___	Yes, a great deal	34	57.6
b___	Yes, quite a lot	13	22.0
c___	Yes, somewhat	6	10.2
d___	No, not at all	4	6.8
e___	I don't know	2	3.4

4. **My child's confidence has improved since exposure to Project SEED.**

a___	Yes, a great deal	28	48.3
b___	Yes, quite a lot	13	22.4
c___	Yes, somewhat	10	17.2
d___	No, not at all	3	5.2
e___	I don't know	4	6.9

5. **My child's math ability has improved since exposure to SEED.**

a___	Yes, a great deal	27	47.4
b___	Yes, quite a lot	11	19.3
c___	Yes, somewhat	12	21.1
d___	No, not at all	4	7.0
e___	I don't know	3	5.3

6. **Other children should be exposed to SEED.**

a___	Yes	44	77.2
b___	No	2	3.5
c___	I don't know	11	19.3

Appendix F-5

Project SEED Parent Survey

District 5

1. **I have observed a Project SEED class.**

a___	Yes	30	22.1
b___	No	106	77.9

2. **My child is excited about studying Algebra through Project SEED.**

a___	Yes, a great deal	67	49.3
b___	Yes, quite a lot	34	25.0
c___	Yes, somewhat	21	15.4
d___	No, not at all	2	1.5
e___	I don't know	12	8.8

3. **My child enjoys the Project SEED classes.**

a___	Yes, a great deal	73	53.7
b___	Yes, quite a lot	33	24.3
c___	Yes, somewhat	21	15.4
d___	No, not at all	2	1.5
e___	I don't know	7	5.1

4. **My child's confidence has improved since exposure to Project SEED.**

a___	Yes, a great deal	48	35.8
b___	Yes, quite a lot	30	22.4
c___	Yes, somewhat	33	24.6
d___	No, not at all	6	4.5
e___	I don't know	17	12.7

5. **My child's math ability has improved since exposure to SEED.**

a___	Yes, a great deal	52	38.2
b___	Yes, quite a lot	35	25.7
c___	Yes, somewhat	36	26.5
d___	No, not at all	4	2.9
e___	I don't know	9	6.6

6. **Other children should be exposed to SEED.**

a___	Yes	118	86.8
b___	No	2	1.5
c___	I don't know	16	11.8

Appendix F-6

Project SEED Parent Survey

Five School Districts

1. I have observed a Project SEED class.

a___	Yes	327	38.2
b___	No	529	61.8

2. My child is excited about studying Algebra through Project SEED.

a___	Yes, a great deal	539	62.5
b___	Yes, quite a lot	191	22.1
c___	Yes, somewhat	95	11.0
d___	No, not at all	9	1.0
e___	I don't know	29	3.4

3. My child enjoys the Project SEED classes.

a___	Yes, a great deal	560	64.9
b___	Yes, quite a lot	191	22.1
c___	Yes, somewhat	83	9.6
d___	No, not at all	11	1.3
e___	I don't know	18	2.1

4. My child's confidence has improved since exposure to Project SEED.

a___	Yes, a great deal	392	45.6
b___	Yes, quite a lot	216	25.1
c___	Yes, somewhat	181	21.1
d___	No, not at all	20	2.3
e___	I don't know	50	5.8

5. My child's math ability has improved since exposure to SEED.

a___	Yes, a great deal	363	42.2
b___	Yes, quite a lot	232	27.0
c___	Yes, somewhat	192	22.3
d___	No, not at all	35	4.1
e___	I don't know	38	4.4

6. Other children should be exposed to SEED.

a___	Yes	771	89.9
b___	No	8	0.9
c___	I don't know	79	9.2